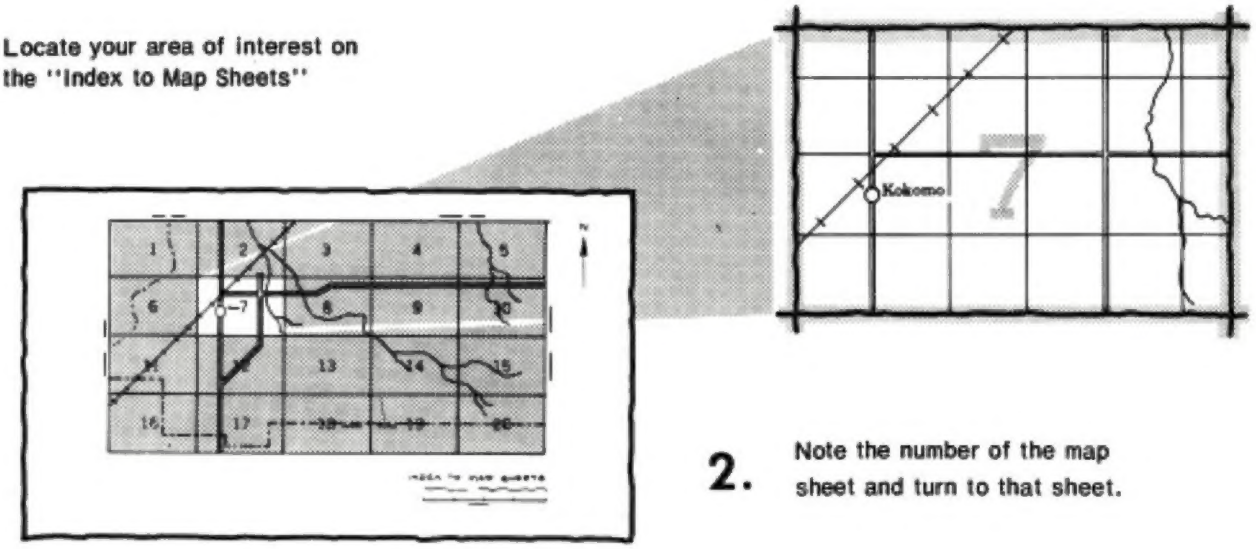
SOIL SURVEY OF

CLAY COUNTY, TEXAS

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
in cooperation with
TEXAS AGRICULTURAL EXPERIMENT STATION

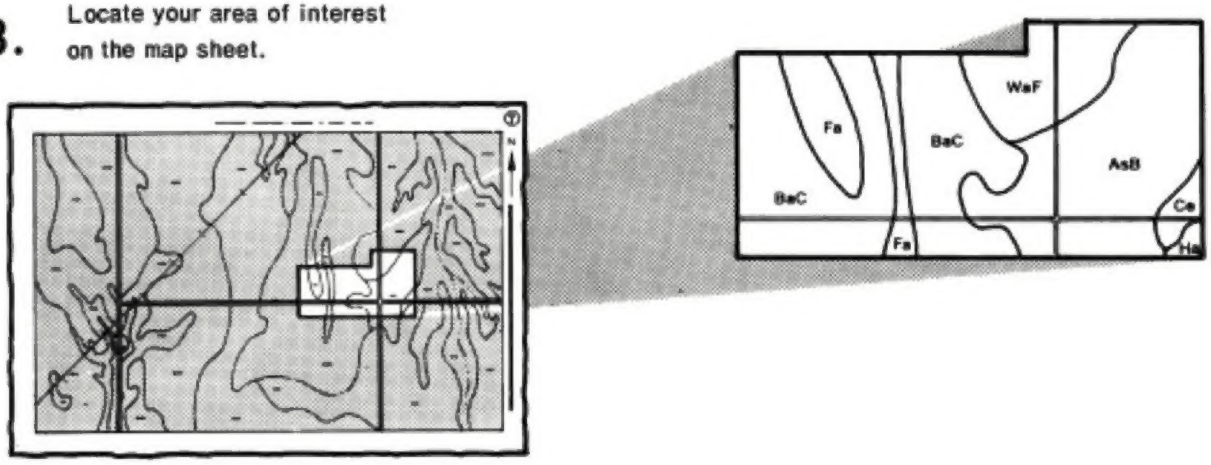
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets"

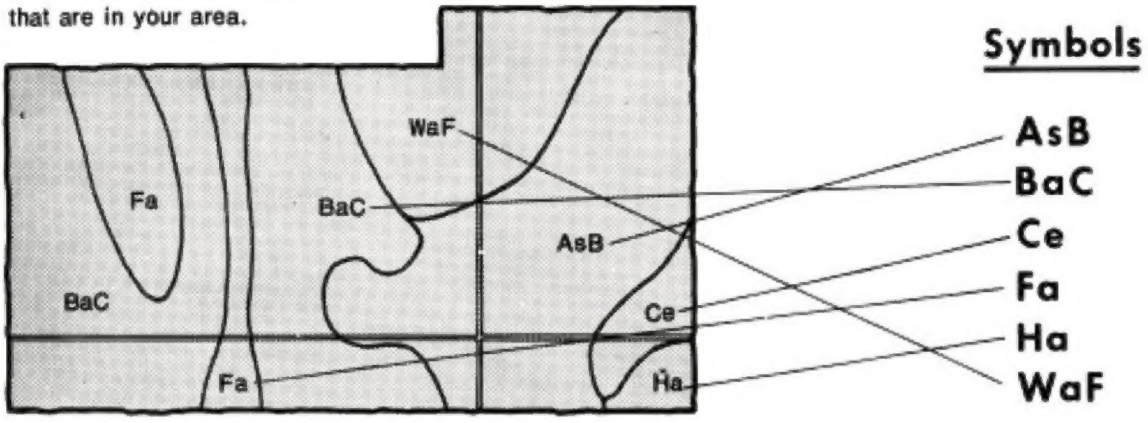


2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.

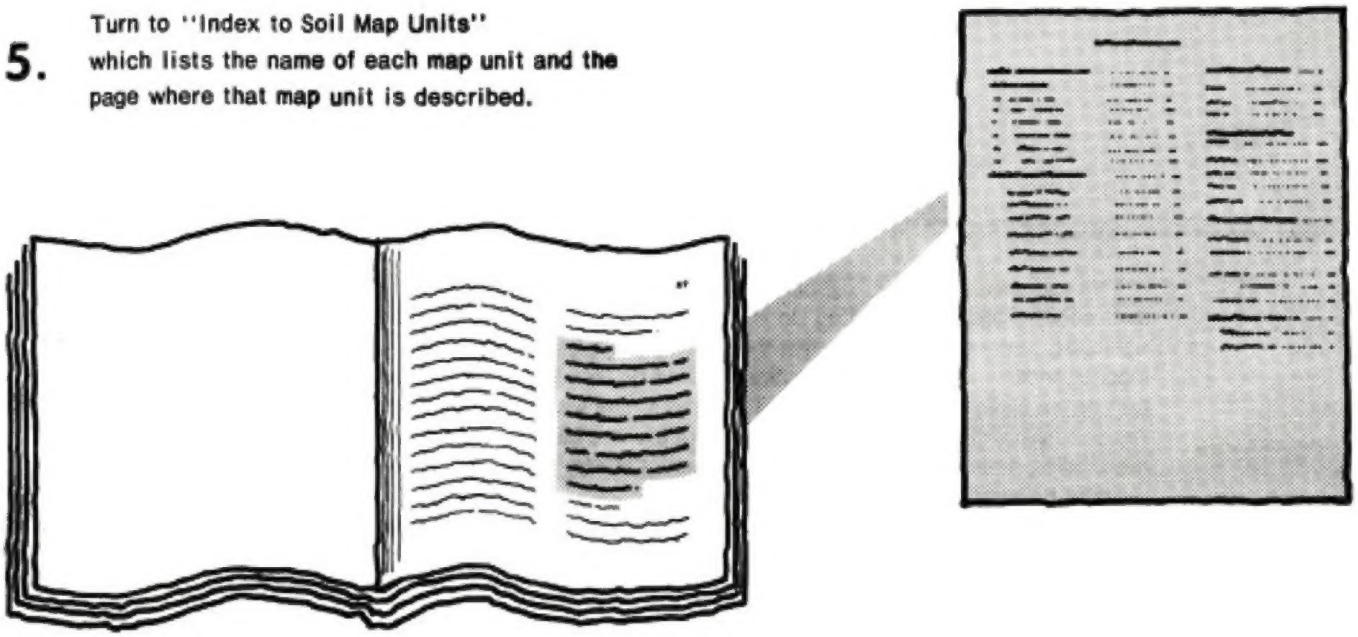


4. List the map unit symbols that are in your area.

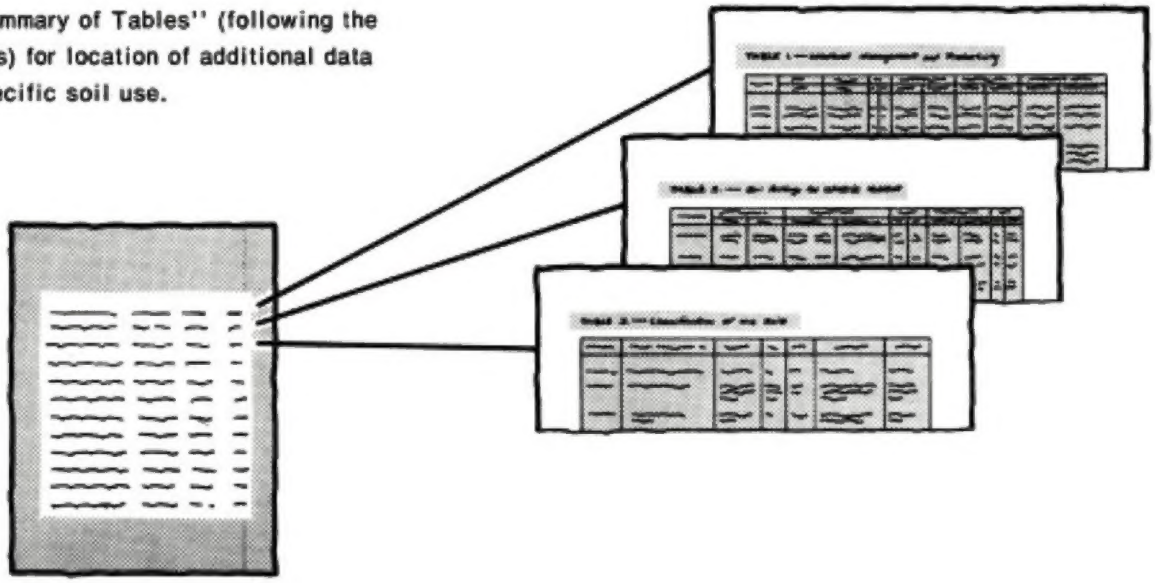


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1972-77. Soil names and descriptions were approved in 1977. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1977. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Little Wichita Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Cattle on Windthorst-Truce complex, 1 to 5 percent slopes. These soils are in Sandy Loam range site.

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soil series

Issued September 1980

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foreword

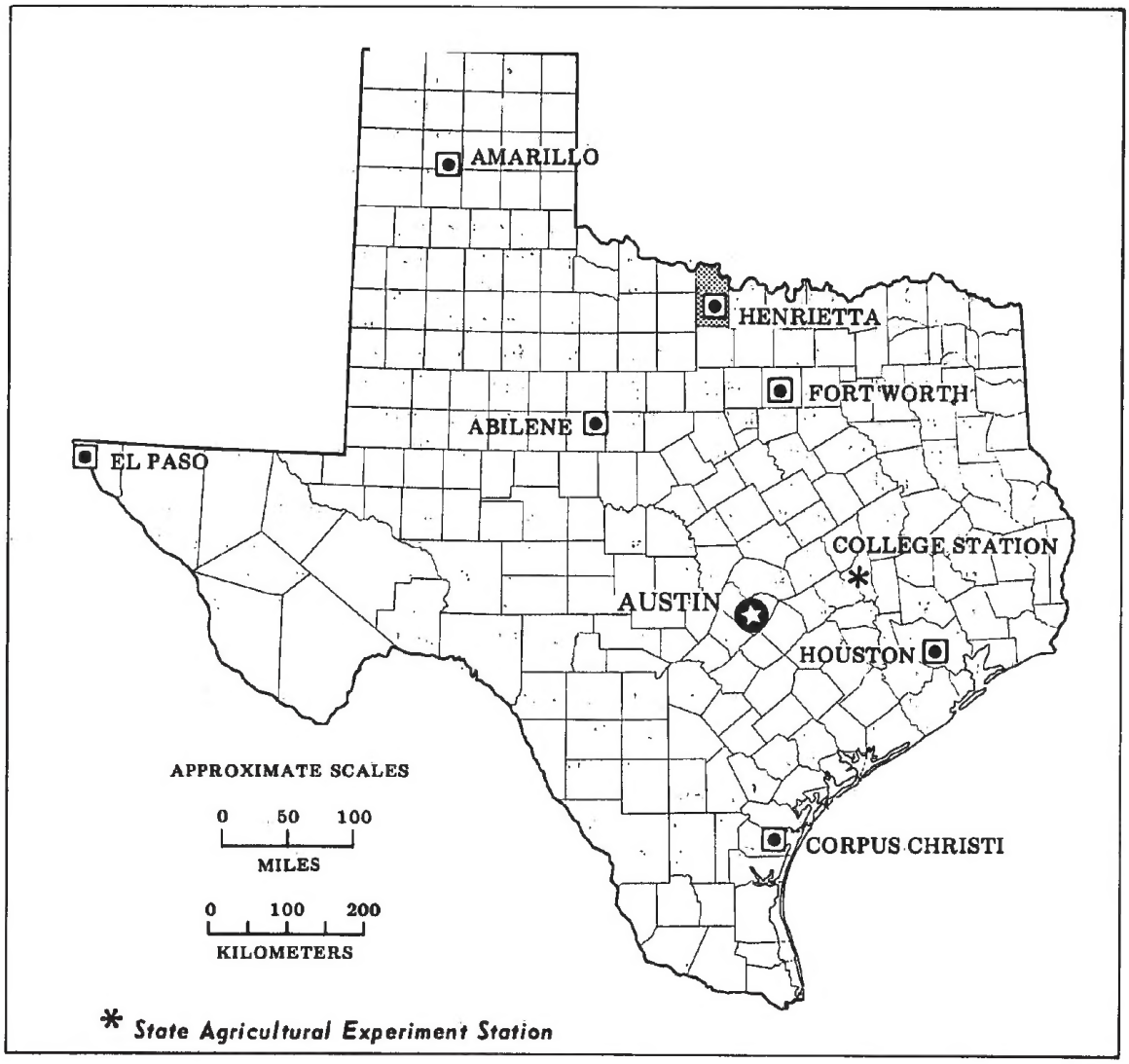
This soil survey contains information that can be used in land-planning programs in Clay County, Texas. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

George C. Marks
State Conservationist
Soil Conservation Service



Location of Clay County in Texas.

soil survey of
Clay County, Texas

By A. R. Goerdel, Soil Conservation Service
United States Department of Agriculture, Soil Conservation Service
in cooperation with Texas Agricultural Experiment Station

Clay County is in the north-central part of Texas. It is bounded by the Red River on the north, by Wichita and Archer Counties on the west, by Montague County on the east, and by Jack County on the south. It includes parts of the Rolling Plains and North Central Prairie Land Resource Areas of Texas.

Physiographically, the area is an old peneplain which has been altered by uplifts and later dissected by creeks and streams. The interstream areas are mostly gently sloping uplands. There are a few low escarpments in the eastern part of the county that are the result of erosion of the alternating clay beds and the more resistant sandstone strata.

Clay County is roughly rectangular. It is about 46 miles from north to south at its longest point, and about 25 miles from east to west. The total area is 1,102 square miles, or 705,280 acres.

In addition to Clay County, Texas, those parts of Jefferson and Cotton Counties, Oklahoma which are south of the Red River channel but north of the Texas-Oklahoma boundary are included in this survey area. The correlated soil names of Clay County were used for this part of the survey area. Although these soil names may differ from those used in the published surveys of Jefferson County and Cotton County, the soils are parallel or closely similar. The acreage of soils surveyed in Jefferson and Cotton Counties is not included in the total acreage for Clay County, Texas.

The land surface is nearly level to undulating and hilly with a few escarpments. The elevation ranges from about 900 feet above sea level in the eastern part of the county to about 1,100 feet above sea level in the southwestern part. Most of the drainage is toward the northeast through the Wichita River, Little Wichita River, Turkey Creek, and Long Creek drainageways. A small area in the southern part of the county drains toward the south into the West Fork of the Trinity River.

general nature of the county

This section gives information about the county. It describes settlement and population, farming, natural resources, and climate.

settlement and population

Clay County was formed on December 24, 1857, from part of Cooke County. It was named for Henry Clay, an American statesman. On May 27, 1873, Clay County was reorganized and its boundaries were set by the General Land Office at Austin.

Cambridge was laid out in 1874. In 1875 it was renamed Henrietta, and was moved three miles to the west to the present site. Henrietta was incorporated on February 15, 1882.

The population of Clay County in 1970 was 8,083. Henrietta, the county seat, had a population of 2,838.

Other incorporated towns in the county are Bellevue, Byers, Petrolia, and Jolly.

farming

Beef cattle is the main agricultural enterprise in Clay County. The average operating unit is about 850 acres.

Livestock operations are primarily cow-calf. Supplemental feeding of range cattle is generally needed from December through the early part of March.

A small acreage in the county is used for nonirrigated crops. Grain sorghum, wheat, and cotton are the main crops. Cultivated crops are used for cash income or as supplemental feed for livestock.

natural resources

Soil is one of the most important natural resources in the county. The production of livestock, feed grains, and forage is a major source of livelihood.

Oil and gas, which are produced from numerous wells in the county, provide an additional source of income to some landowners. Many people are employed by the companies that drill and service oil and gas wells.

climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Clay county is hot in summer but cool in winter when an occasional surge of cold air causes a sharp drop in otherwise mild temperatures. Rainfall is uniformly distributed throughout the year, reaching a slight peak in spring. Snowfalls are infrequent. Annual total precipitation is normally adequate for cotton, feed grain, and small grain.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Henrietta, Texas in the period 1951 to 1975. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 44 degrees F, and the average daily minimum temperature is 30 degrees. The lowest temperature on record, which occurred at Henrietta on January 23, 1966, is -5 degrees. In summer the average temperature is 83 degrees, and the average daily maximum temperature is 95 degrees. The highest recorded temperature, which occurred on August 7, 1951, is 116 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total average annual precipitation is about 30 inches. Of this, 20 inches, or 60 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 15 inches. The heaviest 1-day rainfall during the period of record was 6.07 inches at Henrietta on June 23, 1959. Thunderstorms occur on about 50 days each year, and most occur in spring.

Snowfall is variable. In 70 percent of the winters, there is measurable snowfall. In 30 percent, the snowfall, usually of short duration, is more than 2 inches. The heaviest 1-day snowfall on record was more than 10 inches.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 60 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 13 miles per hour, in spring.

Tornadoes and severe thunderstorms occur occasionally. These storms are local and of short duration, and the pattern of damage is variable and spotty.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The soils in the survey area vary widely in their potential for major land uses. Table 4 shows the extent of the map units shown on the general soil map. It lists the potential of each, in relation to that of the other map units, for major land uses and shows soil properties that limit use. Soil potential ratings are based on the practices commonly used in the survey area to overcome soil limitations. These ratings reflect the ease of overcoming the limitations. They also reflect the problems that will persist even if such practices are used.

Each map unit is rated for *cultivated crops, rangeland, urban uses,* and *recreation uses*. Cultivated crops are those grown extensively in the survey area. Rangeland refers to land in native range plants. Urban uses include residential, commercial, and industrial developments. Recreation uses are campsites, picnic areas, ballfields, and other areas that are subject to heavy foot traffic, and nature study areas and wilderness areas.

Approximately 98 percent of Clay County is land areas that have water areas of less than 40 acres. The other 2 percent is water areas larger than 40 acres.

About 79 percent of the county is used for range and about 17 percent is used for cultivated crops. The main crops grown in the county are cotton, grain sorghum, and wheat. Other crops are vegetables, fruits, and pecans, which are grown on limited acreage and generally require intensive management.

The general soils information in this section and more detailed information in the following sections can be used as a guide in planning orderly growth and development of the county. This information is especially helpful in determining which lands to allocate to each use.

Dominantly moderately deep and deep soils that formed mainly in material weathered from sandstone and shale on uplands

These map units make up about 82 percent of the county. The major soils are Anocon, Bluegrove, Bonti, Deandale, Kamay, Kirkland, Renfrow, Stoneburg, Truce, Waurika, and Windthorst soils. They are nearly level and gently sloping. They have a loamy surface layer and are well drained to somewhat poorly drained. Permeability is moderately slow, slow, and very slow.

Most of these soils are used as rangeland. The main native grasses are buffalograss, bluestem, sideoats grama, vine mesquite, western wheatgrass, and white tridens. Potential is medium for cropland, rangeland, and pasture and is medium or low for urban and recreation uses.

1. Stoneburg-Anocon-Kirkland

Nearly level to gently sloping, well drained loamy soils

This map unit is made up of soils that have slopes ranging from 0 to 5 percent. The unit makes up about 27 percent of the county. It is about 17 percent Stoneburg soils, 16 percent Anocon soils, 13 percent Kirkland soils, and 54 percent other soils.

The moderately deep, gently sloping Stoneburg soils are on convex ridges. Typically, the surface layer is slightly acid, brown loam about 12 inches thick. The subsoil is slightly acid, reddish brown sandy clay loam to a depth of 17 inches. It is neutral, reddish brown clay loam and mildly alkaline, reddish yellow clay loam to a depth of 38 inches. The underlying material is weakly cemented sandstone.

The deep, nearly level to gently sloping Anocon soils are on plane surfaces. The surface layer is slightly acid, grayish brown loam about 13 inches thick. The subsoil is slightly acid, reddish brown clay loam to a depth of 19 inches; neutral, reddish brown clay to a depth of 30 inches; mildly alkaline, yellowish brown clay to a depth of 54 inches; and moderately alkaline, yellowish red clay loam to a depth of 80 inches.

The deep, nearly level Kirkland soils are on plane surfaces. The surface layer is slightly acid or neutral, grayish brown and dark grayish brown silt loam about 12 inches thick. The subsoil is mainly mildly alkaline and moderately alkaline clay to a depth of 80 inches. It is dark grayish brown in the upper part, brown in the middle part, and yellowish red in the lower part.

Other soils are in this map unit. The deep, gently sloping, loamy soils are Renfrow soils on uplands and Grandfield soils on convex terraces near the larger creeks. The deep, nearly level, loamy Port soils are on flood plains. The moderately deep, gently sloping, clayey Vernon soils and the loamy Bluegrove soils are on convex ridges; the sloping, loamy Callahan soils are on sides of ridges; and the nearly level, clayey Treadway soils are on alluvial fans. The shallow, gently sloping to steep, clayey Owens soils are in broken areas; the very shallow, sloping to steep, loamy Nebgen soils are on upland ridges; and the undulating, clayey Knoco soils are in broken areas.

Potential for cultivated crops is medium. The clayey subsoil and depth to rock are the main limitations. Crops are wheat, grain sorghum, and cotton.

The soils in this map unit are mainly used as rangeland. Potential is medium for this use. Depth to rock and a clayey subsoil limit the amount of forage produced. Native range plants are short, mid, and tall grasses.

Potential is low for most urban and recreation uses. Shrinking and swelling with change in moisture, moderately slow and very slow permeability, depth to sandstone, and a clayey subsoil are limitations.

2. Kamay-Bluegrove-Deandale

Nearly level to gently sloping, well drained and moderately well drained loamy soils

This map unit is made up of soils that have slopes ranging from 0 to 5 percent. The unit makes up 24 percent of the county (fig. 1). It is about 33 percent Kamay soils, 21 percent Bluegrove soils, 9 percent Deandale soils, and 37 percent other soils.

The deep, gently sloping Kamay soils are on uplands. Typically, the surface layer is slightly acid, brown silt loam about 9 inches thick. The subsoil is mildly alkaline and moderately alkaline clay to a depth of 63 inches. It is brown in the upper part and yellowish red in the lower part. The underlying material is red and gray clayey shale.

The moderately deep, gently sloping Bluegrove soils are on convex ridges. Typically, the surface layer is

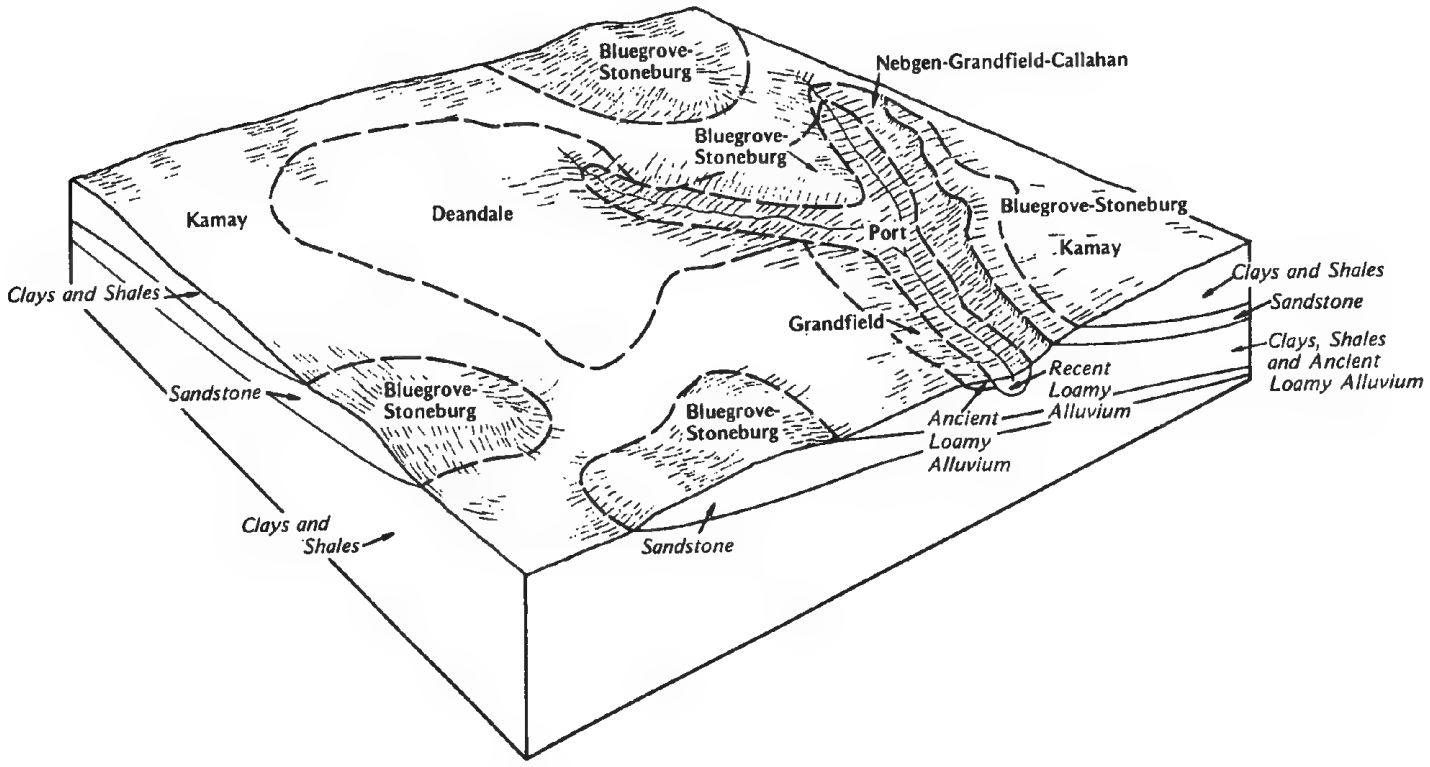


Figure 1.—Relationship of soils in the Kamay-Bluegrove-Deandale association.

slightly acid, brown loam about 6 inches thick. The subsoil is reddish brown clay loam to a depth of 30 inches. It is slightly acid in the upper part and neutral in the lower part. The underlying material is weakly cemented, red and gray sandstone.

The deep, nearly level Deandale soils are on uplands. The surface layer is slightly acid, grayish brown silt loam about 9 inches thick. The subsoil is moderately alkaline and calcareous, very firm clay to a depth of 80 inches. It is dark brown in the upper part, brown in the middle part, and yellowish red in the lower part.

Other soils are in this map unit. The deep soils are the nearly level, loamy Port soils on flood plains of streams and drainageways and the gently sloping, loamy Grandfield soils on convex terraces near the larger drainageways. The moderately deep soils are the gently sloping, clayey Vernon soils on convex ridges; the nearly level, clayey Treadway soils on alluvial fans; the sloping, loamy Callahan soils on side slopes of ridges; and the gently sloping Stoneburg soils that occur in association with Bluegrove soils on convex ridges. The shallow, clayey Owens soils and the very shallow, clayey Knoco soils are on breaks of erosional landscapes. The very shallow, sloping to steep, loamy Nebgen soils are on side slopes of ridges.

Potential is medium for cultivated crops. The shallow rooting depth and clayey subsoil are limitations that contribute to droughtiness. Crops are wheat, grain sorghum, and cotton.

The soils in this map unit are mainly used as rangeland, and the potential for this use is medium. Depth to rock and the clayey subsoil limit the amount and kind of forage produced. Native range plants are short and mid grasses.

Potential is low for most urban and recreation uses. Shrinking and swelling of the soil with changes in moisture, moderately slow and very slow permeability, depth to sandstone, and the clayey subsoil are limitations.

3. Bonti-Windthorst-Truce

Gently sloping, well drained to moderately well drained loamy soils

This map unit is made up of gently sloping soils that have slopes ranging from 1 to 5 percent. The unit makes up 18 percent of the county. It is about 45 percent Bonti soils, 15 percent Windthorst soils, 12 percent Truce soils, and 28 percent other soils.

The moderately deep Bonti soils are on convex ridges. Typically, the surface layer is brownish, neutral, fine sandy loam about 6 inches thick. The subsoil is firm sandy clay to a depth of 36 inches. It is dark red and medium acid in the upper part and red and slightly acid in the lower part. Yellowish sandstone is at a depth of 36 inches.

The deep Windthorst soils are in areas below sandstone ridges. Typically, the surface layer is slightly hard, neutral, brown fine sandy loam about 9 inches thick. The subsoil is slightly acid, reddish brown sandy clay to a depth of 33 inches. Below that is slightly acid, mottled yellowish, grayish, and reddish sandy clay to a depth of 68 inches. The substratum is neutral, mottled yellow, gray, and red sandy clay.

The deep Truce soils are in areas below the sandstone ridges. Typically, the surface layer is neutral, brown fine sandy loam about 6 inches thick. The subsoil is mainly mildly alkaline and moderately alkaline, very firm clay to a depth of 49 inches. It is reddish brown in the upper part, light yellowish brown in the middle part, and light olive gray in the lower part. The underlying material is clayey shale.

Other soils are in this unit. The deep soils are the loamy Gowen soils on flood plains; the nearly level, sandy Chaney soils in shallow valleys; the gently sloping, sandy Duffau soils on foot slopes below sandstone ridges; and the gently sloping, loamy Cisco soils on stream terraces. The moderately deep soils are the nearly level to gently sloping, sandy Stephenville soils on sandstone ridges. The shallow soils are the sloping, loamy Darnell soils on sandstone ridges and the clayey Owens soils on eroded, broken areas. The very shallow soils are the sloping to steep, loamy Nebgen soils on sandstone ridges and the clayey Knoco soils on eroded, broken areas.

Potential is medium for cultivated crops. Depth to rock and slope are the main limitations.

Most of the soils in this unit are in wooded rangeland. Native vegetation is mid and tall grasses that have an overstory of post oak and blackjack oak. Potential is medium for rangeland. Depth to rock and slope limit the kinds and amount of forage produced.

Potential is medium for most urban and recreation uses. Depth of the soil, moderately slow and slow permeability, and shrinking and swelling of the soil with changes in moisture are the main limitations.

4. Renfrow-Bluegrove-Waurika

Nearly level to gently sloping, well drained to somewhat poorly drained loamy soils

This map unit is made up of soils that have slopes ranging from 0 to 5 percent. The unit makes up about 13 percent of the county. It is about 26 percent Renfrow soils, 19 percent Bluegrove soils, 13 percent Waurika soils, and 42 percent other soils.

The deep, nearly level to gently sloping Renfrow soils are on upland areas that have plane surfaces. Typically, the surface layer is slightly acid, brown loam about 9 inches thick. The subsoil is reddish brown clay loam to a depth of 30 inches. It is slightly acid in the upper part and neutral in the lower part. Between depths of 30 and 80 inches, the subsoil is moderately alkaline, yellowish red clay.

The moderately deep, gently sloping Bluegrove soils are on convex, upland ridges. Typically, the surface layer

is slightly acid, brown loam about 6 inches thick. The subsoil is reddish brown clay loam to a depth of 30 inches. It is slightly acid in the upper part and neutral in the lower part. The underlying material is weakly cemented sandstone.

The deep, nearly level Waurika soils are on upland areas that have plane surfaces. Typically, the surface layer is about 14 inches thick. It is slightly acid, grayish brown silt loam in the upper part and grades to light brownish gray in the lower part. The subsoil is neutral, dark grayish brown clay to a depth of 39 inches. Below that is moderately alkaline, brown clay to a depth of 65 inches. The substratum is light brownish gray clay.

Other soils are in this map unit. The deep soils are the nearly level, loamy Gowen soils on flood plains; the sloping, loamy Truce soils on uplands below sandstone ridges; the gently sloping, loamy Grandfield soils on stream terraces; and the gently sloping, loamy Windthorst soils on uplands below sandstone ridges. The moderately deep soils are the nearly level, clayey Treadway soils on alluvial fans; the sloping, loamy Callahan soils on side slopes of upland ridges; and the gently sloping, loamy Stoneburg soils on convex upland ridges. The shallow soils are the sloping, loamy Darnell soils on sandstone ridges and the clayey Owens soils on eroded, broken areas and erosional areas. The very shallow soils are the sloping, loamy Nebgen soils on sandstone ridges and the clayey Knoco soils on eroded, broken areas and erosional areas.

Potential is medium for cultivation. The clayey subsoil, which restricts movement of crop roots and causes droughtiness, is the main limitation.

Most of the soils in this unit are used as rangeland. Potential is medium for this use. Droughtiness and the clayey subsoil limit the kind and amount of native range plants.

Potential is low for most urban uses. Clayey subsoil, shrinking and swelling of the soil with changes in moisture, and very slow permeability are limitations.

Potential is low for recreation uses. Very slow permeability and clayey texture are limitations.

Dominantly deep soils that formed in eolian and alluvial sediments on uplands

These map units make up about 8 percent of the county. The major soils are Devol, Enterprise, Minco, Motley, and Teller soils. They have a loamy to sandy surface layer. These soils are nearly level to moderately steep. They are well drained, and permeability is moderate or moderately rapid.

Most of these soils are used as cropland. The main crops are wheat, grain sorghum, and cotton. Native grasses are bluestems, indiangrass, and switchgrass. Potential is high for cropland, rangeland, and pasture and for urban and recreation uses.

5. Teller-Minco-Motley

Nearly level to sloping, well drained loamy soils

This map unit is made up of deep soils that have slopes ranging from 0 to 8 percent. The unit makes up about 5 percent of the county (fig. 2). It is about 21 percent Teller soils, 16 percent Minco soils, 16 percent Motley soils, and 47 percent other soils.

The nearly level Teller soils are on upland areas that have plane surfaces. Typically, the surface layer is slightly acid, brown loam about 8 inches thick. The subsoil is neutral, brown sandy clay loam to a depth of 48 inches and moderately alkaline yellowish brown sandy clay loam to a depth of 60 inches. The substratum is brownish yellow, moderately alkaline sandy clay loam.

The nearly level to sloping Minco soils are on upland areas that have convex surfaces. Typically, these soils are reddish brown very fine sandy loam to a depth of about 50 inches. The upper part is medium acid, the middle part is neutral, and the lower part is mildly alkaline. Below that is moderately alkaline, yellowish red very fine sandy loam to a depth of 80 inches.

The nearly level to gently sloping Motley soils are on upland areas that have convex surfaces. Typically, the surface layer is neutral, brown loam about 7 inches thick. The subsoil is sandy clay loam to a depth of 63 inches. It is reddish brown and neutral in the upper part and red and moderately alkaline in the lower part. Below that, the subsoil is moderately alkaline, red loam to a depth of 80 inches.

Other soils are in this map unit. The deep soils are the nearly level, loamy Altus soils on concave upland areas; the nearly level to sloping, loamy Bastrop soils on upland terraces; the nearly level to gently sloping, loamy Deandale and Winters soils on upland areas that have plane surfaces; and the sloping to steep, loamy Enterprise soils on upland areas that have convex surfaces.

Most of the soils in this unit are cultivated. The main crops are wheat, cotton, and grain sorghum.

Potential is high for cultivated crops and for native range plants. Potential is also high for most urban and recreation uses; however, slope is a limitation in some areas.

6. Devol-Enterprise

Nearly level to moderately steep, well drained sandy and loamy soils

This map unit is made up of soils that have slopes ranging from 0 to 20 percent. The unit makes up 3 percent of the county. It is about 46 percent Devol soils, 35 percent Enterprise soils, and 19 percent other soils.

The nearly level to gently sloping Devol soils are on upland areas. Typically, the surface layer is loose, slightly acid, light brown loamy fine sand about 13 inches thick. The subsoil is very friable, reddish brown fine sandy loam to a depth of 55 inches. It is neutral in the

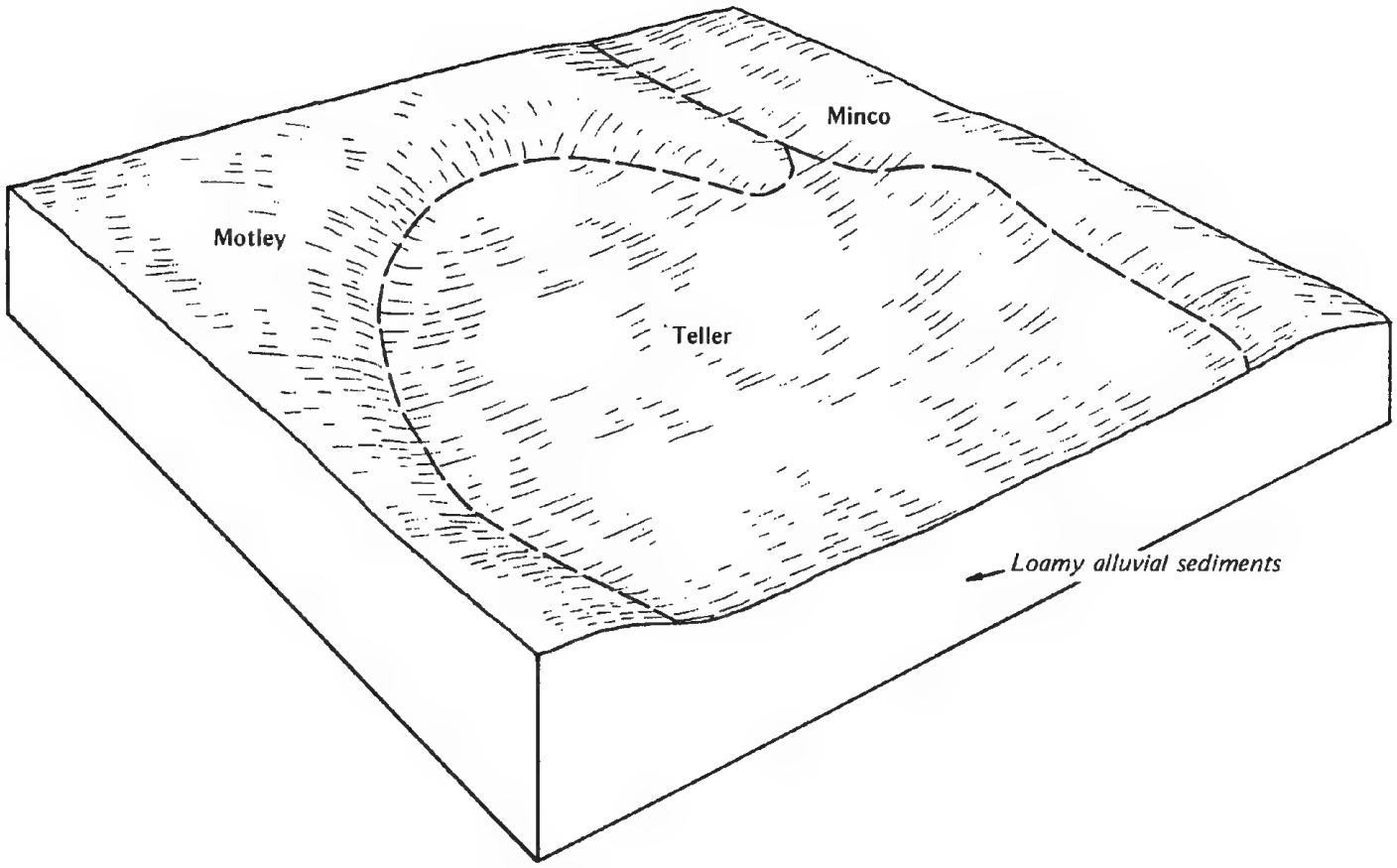


Figure 2.—Relationship of soils in the Teller-Minco-Motley association.

upper part and mildly alkaline in the lower part. The substratum is loose, mildly alkaline, yellowish red loamy fine sand.

The nearly level to moderately steep Enterprise soils are on upland areas that have convex surfaces. Typically, these soils are reddish brown very fine sandy loam to a depth of 46 inches. This layer is neutral in the upper part, mildly alkaline in the middle part, and moderately alkaline in the lower part. Below that is moderately alkaline, reddish yellow very fine sandy loam to a depth of 75 inches.

Other soils are in this map unit. The deep, gently sloping, sandy Grandfield soils are on upland areas. The loamy Port soils are on flood plains of drainageways. The nearly level, loamy Winters and Teller soils are on low stream terraces.

The soils in this map unit are used as cropland, rangeland, and orchards. Potential is medium for cultivated crops. The sandy surface texture and slope are limitations on Devol soils because of the erosion hazard. Potential is high for cultivated crops on the less sloping Enterprise soils. The main crop is wheat. Potential is high for native range plants. Potential is high for most urban and recreation uses. Low strength and slope are limitations in some areas.

Deep soils that formed in alluvium on flood plains

These map units make up about 8 percent of the county. The major soils are Mangum, Lincoln, Ships, Weswood, and Yomont soils. Texture of the surface layer is loamy or clayey. These soils are nearly level and gently sloping. They are somewhat excessively drained, well drained, or moderately well drained. Permeability ranges from rapid to very slow.

About 50 percent of these soils is used as cropland. The rest is used as rangeland. Wheat and grain sorghum are the main crops. Native vegetation consists of buffalograss on the clayey soils and bluestems, indiangrass, and switchgrass on the loamy soils. Potential for cropland, rangeland, and pastureland is high on the loamy soils and low on the clayey soils. Potential is low for urban and recreation uses.

7. Weswood-Mangum

Nearly level, well drained to moderately well drained loamy and clayey soils

This map unit is made up of deep, nearly level soils that have slopes of 0 to 1 percent. The unit makes up 4 percent of the county. It is about 44 percent Weswood soils, 26 percent Mangum soils, and 30 percent other soils.

The Weswood soils are on flood plains. Typically, the surface layer is moderately alkaline, calcareous, reddish brown silt loam about 8 inches thick. Below that is calcareous, moderately alkaline, reddish brown silty clay loam to a depth of 80 inches.

The Mangum soils are on flood plains. Typically, the surface layer is moderately alkaline, calcareous, reddish brown silty clay loam about 10 inches thick. Below that is moderately alkaline, calcareous, reddish brown clay to a depth of 60 inches. Some areas of the Mangum soils are clayey throughout the profile.

Other soils in this unit are the deep, nearly level, loamy Yomont soils on flood plains and the deep, nearly level, loamy Nipsum soils on alluvial fans.

Most of the soils in this map unit are cultivated. A few areas are used as rangeland. Wheat is the main crop.

Potential is high for cultivated crops. Potential is high for native range plants. Potential is low for most urban and recreation uses. The hazard of flooding and shrinking and swelling of the soil with changes in moisture are limitations.

8. Ships-Mangum

Nearly level, moderately well drained clayey soils

This unit is made up of deep, nearly level soils that have slopes of 0 to 1 percent. The unit makes up about 3 percent of the county. It is about 37 percent Ships soils, 21 percent Mangum soils, and 42 percent other soils.

The Ships soils are on flood plains. Typically, these soils are very firm, moderately alkaline, reddish brown clay to a depth of about 50 inches. Below that is very firm, moderately alkaline, red clay to a depth of 60 inches.

The Mangum soils are on flood plains. Typically, these soils are moderately alkaline, reddish brown clay to a depth of 60 inches.

Other soils in this map unit are deep, nearly level, loamy Weswood and Port soils on flood plains. The deep, gently sloping, loamy Cisco and Grandfield soils are on higher convex ridges within the flood plain.

Potential is low for crops. The clayey surface is a limitation that causes droughtiness. Flooding is a hazard.

Most of the soils in this unit are used as rangeland. Potential is medium for native range plants. The clayey texture of these soils causes droughtiness.

Potential is low for urban and recreation uses. The clayey texture, shrinking and swelling of the soil with changes in moisture, susceptibility to flooding, and very slow permeability are limitations.

9. Yomont-Lincoln

Nearly level to gently sloping, well drained and somewhat excessively drained loamy soils

This map unit is made up of deep soils that have slopes ranging from 0 to 3 percent. The unit makes up about 1 percent of the county. It is about 55 percent Yomont soils, 30 percent Lincoln soils, and 15 percent other soils.

The deep, nearly level and gently sloping Yomont soils are on flood plains. Typically, the surface layer is moderately alkaline, reddish brown very fine sandy loam about 7 inches thick. The substratum is moderately alkaline, reddish brown very fine sandy loam stratified with silt loam and loamy very fine sand. Some areas of the Yomont soils have a reddish brown silt loam surface layer about 9 inches thick.

The deep Lincoln soils are on low flood plains. Typically, the surface layer is moderately alkaline, reddish brown fine sandy loam about 10 inches thick. The substratum is moderately alkaline, reddish yellow fine sand.

Other soils in this map unit are the deep, nearly level, loamy Weswood soils on bottom lands and the deep, sloping, sandy Tivoli soils on convex upland ridges within the flood plain.

Potential is low for cultivated crops. The hazard of flooding and the sandy texture of the soils are limitations.

The soils in this map unit are mainly used as rangeland. Potential is high for native range plants. These plants are mid and tall grasses.

Potential is low for most urban and recreation uses. The hazard of flooding is a limitation.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

This survey has both narrowly defined and broadly defined units. Broadly defined units are more variable in composition than other units but can be interpreted for the expected uses of the soils. They are indicated by a footnote on the soil legend at the back of this publication.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Stephenville loamy fine sand, 0 to 3 percent slopes, is one of several phases in the Stephenville series.

Some map units are made up of two or more major soils. These map units are called soil complexes, soil associations, or undifferentiated groups.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Darnell-Truce complex, 3 to 12 percent slopes, is an example.

A *soil association* is made up of two or more geographically associated soils that are shown as one unit on the maps. Because of present or anticipated soil uses in the survey area, it was not considered practical or necessary to map the soils separately. The pattern and relative proportion of the soils are somewhat similar. Bluegrove-Stoneburg association, gently sloping, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in a mapped area are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Gowen soils, frequently flooded, is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

Table 5 gives the acreage and proportionate extent of each map unit. Other tables (see "Index to tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

1—Altus fine sandy loam, 0 to 3 percent slopes. This deep, nearly level to gently sloping soil is on uplands.

Typically, the surface layer is grayish brown fine sandy loam about 12 inches thick. The subsoil extends to a depth of 50 inches. It is very pale brown sandy clay loam to a depth of 24 inches and brown sandy clay loam to a depth of 50 inches. The substratum is white clay. This soil is moderately alkaline and calcareous throughout the profile.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is medium. A perched seasonal high water table is at a depth of 3 to 6 feet in spring. The hazard of soil blowing is medium, and the hazard of water erosion is low to medium. The shrink-swell potential is low.

Included with this soil in mapping are areas of Devol, Enterprise, and Teller soils. These soils are at a higher elevation than the Altus soil. The included soils make up as much as 10 percent of a mapped area.

This Altus soil is used for range.

It has low potential for cultivated crops. The soil is wet in spring because of a perched high water table.

The potential is medium for improved pasture grasses.

This soil has medium potential for native range plants and for wildlife habitat.

Potential is low for most urban uses because of wetness. Low strength is a limitation for local roads and streets. The potential is high for recreation uses.

This soil is in capability subclass IIIe and Sandy Loam range site.

2—Bastrop fine sandy loam, 0 to 1 percent slopes. This deep, nearly level soil is on uplands.

Typically, the surface layer is medium acid, dark grayish brown fine sandy loam about 9 inches thick. The subsoil extends to a depth of 60 inches or more. It is slightly acid, reddish brown sandy clay loam to a depth of 42 inches and mildly alkaline, red sandy clay loam to a depth of 60 inches.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is high. The hazard of soil blowing is medium, and the hazard of water erosion is low. The shrink-swell potential is low.

Included with this soil in mapping are small areas of Teller soils that make up as much as 10 percent of some mapped areas.

This Bastrop soil has high potential for cultivated crops. Wheat, cotton, and grain sorghum are the main crops. Leaving crop residue on the surface, timely and limited tillage, and the rotation of crops help to control soil blowing and water erosion and to conserve soil moisture. Use of residue also helps to maintain productivity. Emergency tillage is occasionally needed to roughen the surface. Roughening helps to reduce damage by soil blowing if crop growth and residue do not produce adequate cover. Timely application of fertilizer increases yields.

The potential is high for improved pasture grasses, such as bermudagrass and kleingrass. Weed control, proper grazing, and fertilizer help to increase the quantity and improve the quality of forage.

This soil has high potential for native range plants and for wildlife habitat. Tall and mid grasses, post oak, and blackjack oak are the main native vegetation.

Potential is high for most urban and recreation uses. Low strength is a limitation for local roads and streets.

This soil is in capability class I and Sandy Loam range site.

3—Bastrop fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands. Areas are several hundred acres.

Typically, the surface layer is slightly acid, dark grayish brown fine sandy loam about 8 inches thick. The subsoil extends to a depth of 80 inches. It is slightly acid, reddish brown sandy clay loam to a depth of 32 inches; neutral, red sandy clay loam to a depth of 40 inches; and red sandy clay loam that is mildly alkaline in the upper part and moderately alkaline in the lower part to a depth of 80 inches.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is high. The hazards of soil blowing and water erosion are moderate. The shrink-swell potential is low.

Included with this soil in mapping are small areas of Teller soils that make up as much as 10 percent of some mapped areas.

This Bastrop soil is used for cultivated crops, pasture, and range. Wheat is the main crop, but cotton and grain sorghum are also grown.

The potential is high for cultivated crops. Leaving crop residue on the surface, timely and limited tillage, rotation of crops, terracing, and contour farming help to control soil blowing and water erosion and to conserve soil moisture. Use of residue also helps to maintain productivity. Emergency tillage is occasionally needed to roughen the surface. Roughening helps to reduce damage by soil blowing if crop growth and residue do not produce adequate cover. Timely application of fertilizer increases yield.

This soil has high potential for improved pasture grasses, such as bermudagrass and kleingrass. Weed control, proper grazing, and fertilizer improve the quality and increase the quantity of forage.

The potential is high for native range plants and for wildlife habitat. Tall and mid grasses, post oak, and blackjack oak are the main native vegetation.

Potential is high for most urban and recreation uses. Low strength is a limitation for local roads and streets.

This soil is in capability subclass IIe and Sandy Loam range site.

4—Bastrop fine sandy loam, 3 to 5 percent slopes. This deep, gently sloping soil is on uplands.

Typically, the surface layer is slightly acid, dark grayish brown fine sandy loam about 7 inches thick. The subsoil extends to a depth of 60 inches or more. It is slightly acid, reddish brown sandy clay loam to a depth of 29 inches; neutral, red sandy clay loam to a depth of 36 inches; and moderately alkaline, red sandy clay loam to a depth of 60 inches.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is high. The hazards of soil blowing and water erosion are moderate. The shrink-swell potential is low.

Included with this soil in mapping are small areas of Grandfield soils and Motley soils that make up as much as 10 percent of some mapped areas.

This Bastrop soil is used for cultivated crops and range.

This soil has medium potential for cultivated crops. Surface runoff and the hazard of water erosion are limitations. Leaving crop residue on the surface, timely and limited tillage, crop rotation, terracing, and contour

farming help to control soil blowing and water erosion and to conserve soil moisture. Use of residue also helps to maintain productivity. Emergency tillage is occasionally needed to roughen the surface. Roughening helps to reduce damage by soil blowing if crop growth or residue do not produce adequate cover. Timely application of fertilizer increases yield.

The potential is high for improved pasture grasses, such as bermudagrass and kleingrass. Weed control, proper grazing, and fertilizer improve the quality and increase the quantity of forage.

This soil has high potential for native range plants and for wildlife habitat. Tall and mid grasses, post oak, and blackjack oak are the main native vegetation.

Potential is medium to high for most urban and recreation uses. Slope can be a limitation for some uses. Low strength is a limitation for local roads and streets.

This soil is in capability subclass IIIe and Sandy Loam range site.

5—Bastrop fine sandy loam, 5 to 8 percent slopes. This deep, sloping soil is on uplands. Areas are long and narrow.

Typically, the surface layer is slightly acid, dark grayish brown fine sandy loam about 6 inches thick. The subsoil extends to a depth of 60 inches or more. It is slightly acid, reddish brown sandy clay loam to a depth of 29 inches; neutral, red sandy clay loam to a depth of 36 inches; and moderately alkaline, red sandy clay loam to a depth of 60 inches.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is high. The hazard of water erosion is moderate to severe, and the hazard of soil blowing is moderate. The shrink-swell potential is low.

Included with this soil in mapping are small areas of Minco soil and Grandfield soil that make up as much as 10 percent of some mapped areas.

This Bastrop soil has low potential for cultivated crops. The hazard of water erosion and runoff are limitations. Leaving crop residue on the surface, timely and limited tillage, rotation of crops, terracing, and contour farming help to control soil blowing and water erosion and to conserve soil moisture. Use of residue also helps to maintain productivity. Emergency tillage is occasionally needed to roughen the surface. Roughening helps to reduce damage by soil blowing if crop growth and residue do not produce adequate cover. Timely application of fertilizer increases yield.

The potential is medium for improved pasture grasses, such as bermudagrass and kleingrass. Weed control, controlled grazing, and fertilizer increase the quantity and improve the quality of forage.

This soil has high potential for native range plants and for wildlife habitat. Tall and mid grasses are the main native vegetation.

Potential is medium for most urban and recreation uses. Slope is the main limitation. Low strength is a limitation for local roads and streets.

This soil is in capability subclass IVe and Sandy Loam range site.

6—Bluegrove-Stoneburg association, gently sloping. These moderately deep, gently sloping soils are on uplands. Slopes average about 2.5 percent but range from 1 to 5 percent. Areas range from 20 to 300 acres.

The Bluegrove soils make up about 70 percent of this association; Stoneburg soils, 20 percent; and other soils, about 10 percent. The Bluegrove and Stoneburg soils are intermingled on similar kinds of landforms. The composition of this association is more varied than that of other map units in Clay County. Mapping has been controlled well enough, however, for the anticipated use of the area.

Typically, the Bluegrove soil has a surface layer of slightly acid, brown loam about 6 inches thick. The subsoil extends to a depth of 30 inches. It is slightly acid, reddish brown clay loam to a depth of 14 inches and neutral, reddish brown clay loam to a depth of 30 inches. The underlying material is weakly cemented sandstone.

Typically, the Stoneburg soil has a surface layer of slightly acid, brown loam about 12 inches thick. The subsoil extends to a depth of 38 inches. It is slightly acid, reddish brown sandy clay loam to a depth of 17 inches; neutral, reddish brown clay loam to a depth of 28 inches; and mildly alkaline, reddish yellow clay loam to a depth of 38 inches. The underlying material is weakly cemented sandstone.

These soils are well drained. Surface runoff is medium. Permeability is moderately slow, and available water capacity is low. The root zone is moderately deep. The hazard of water erosion is moderate, and the hazard of soil blowing is slight. The shrink-swell potential is moderate.

Included with these soils in mapping are areas of soils on or near ridgetops that are similar to Bluegrove and Stoneburg soils but are less than 20 inches deep to sandstone. Also included are small areas of Callahan soils on mid to lower side slopes and Anocon soils on lower side slopes. A few areas of nearly level Kamay soils are included. Outcrops of sandstone occur on upper side slopes in some areas. The included soils make up an average of 10 percent of the mapped areas.

This Bluegrove-Stoneburg association is used mainly for range, but a few areas are used for cultivated crops. Wheat is the main crop.

These soils have medium potential for most cultivated crops. Leaving crop residue on the surface, timely and limited tillage, rotation of crops, terracing, contour farming, and grassed waterways help to control soil blowing and water erosion and to conserve soil moisture. Use of residue also helps to maintain productivity. Emergency tillage is occasionally needed to roughen the surface. Roughening helps to reduce damage from soil blowing if crop growth and residue do not produce adequate cover. Timely application of fertilizer increases yield.

The potential is medium for improved pasture grasses, such as bermudagrass and kleingrass. Weed control, controlled grazing, and fertilizer are needed to improve the quality and increase the quantity of forage.

These soils have medium potential for native range plants and for wildlife habitat. Short and mid grasses are the main native vegetation.

Potential is medium for most urban and recreation uses. Depth to sandstone, shrinking and swelling properties, and low strength are limitations.

The Bluegrove soils are in capability subclass IIe and Tight Sandy Loam range site. The Stoneburg soils are in capability subclass IIIe and Loamy Prairie range site.

7—Bonti fine sandy loam, 1 to 5 percent slopes. This moderately deep, gently sloping soil is on uplands. Slopes are convex and average about 2.5 percent. Areas range from 35 to 500 acres.

Typically, the surface layer is neutral, dark yellowish brown and brown fine sandy loam about 6 inches thick. The subsoil extends to a depth of 36 inches. It is medium acid, red sandy clay to a depth of 19 inches; slightly acid, red sandy clay to a depth of 29 inches; and slightly acid, interbedded yellowish red sandy clay and yellow, weakly cemented sandstone to a depth of 36 inches. Yellowish cemented sandstone is at a depth of 36 inches (fig. 3).

This soil is well drained. Surface runoff is rapid. Permeability is moderately slow, and available water capacity is low. The hazards of soil blowing and water erosion are moderate. The shrink-swell potential is moderate.

Included with this soil in mapping are small areas of soils similar to Bonti soil that are less than 20 inches to sandstone and a few small areas of Renfrow soils. The included soils make up as much as 20 percent of a mapped area.

This Bonti soil is suitable for cultivation, but it is used mainly for rangeland.

This soil has medium potential for native range plants. Tall and mid grasses, forbs, and oak trees are the main native vegetation. Proper stocking, controlled grazing, and brush management are needed. Potential is high for wildlife habitat.

The potential is medium for cultivated crops. Keeping crop residue on the surface helps to conserve soil moisture, control soil blowing, and maintain tilth. Terracing and contour farming help to control water erosion.

This soil has medium potential for improved pasture grasses. Coastal bermudagrass, weeping lovegrass, King Ranch bluestem, and kleingrass are well suited. Controlled grazing, weed control, and fertilizer are needed to maintain high production of high quality forage.

Potential is medium for most urban and recreation uses. Low strength, depth to sandstone, shrinking and swelling properties, and moderately slow permeability are the main limitations.

Figure 3.—Profile of Bonti fine sandy loam. Sandstone is at a depth of about 24 inches.

This soil is in capability subclass IIe and Tight Sandy Loam range site.

8—Chaney loamy fine sand, 0 to 3 percent slopes. This deep, sandy soil is on uplands. Slopes are concave. Areas average about 100 acres.

Typically, the surface layer is neutral, dark yellowish brown loamy fine sand about 6 inches thick. The subsurface layer is mildly alkaline, yellowish brown loamy fine sand about 9 inches thick. The subsoil extends to a depth of 65 inches. It is mildly alkaline, yellowish brown

sandy clay to a depth of 25 inches; mildly alkaline, gray sandy clay to a depth of 45 inches; and mildly alkaline, light gray sandy clay loam to a depth of 65 inches. The substratum is moderately alkaline, light gray sandy clay loam.

This soil is moderately well drained. Surface runoff is low. Permeability is slow, and available water capacity is medium. This soil commonly has a perched water table for a few days after heavy rainfall. The hazard of soil blowing is severe, and the hazard of water erosion is slight. The shrink-swell potential is moderate.

Included with this soil in mapping are small areas of Duffau, Stephenville, and Windthorst soils. These soils make up as much as 15 percent of each mapped area.

This Chaney soil is mainly used for range or improved pasture grasses. A few areas are used for cultivated crops. Small grain and sorghum are the main crops.

This soil has medium potential for most crops. Leaving crop residue on the surface, timely and limited tillage, and crop rotation help to control soil blowing and water erosion, conserve soil moisture, and maintain productivity. Timely application of fertilizer increases yield.

The potential is high for improved pasture grasses, such as coastal bermudagrass, kleingrass, and lovegrass. Weed control, controlled grazing, and fertilizer help to improve the quality and increase the quantity of forage.

This soil has high potential for native range plants and for wildlife habitat. Tall and mid grasses, post oak, and blackjack oak are the main native vegetation.

Potential is medium for most urban and recreation uses. Shrinking and swelling properties and low strength are limitations for urban uses. The sandy surface layer limits recreation uses.

This soil is in capability subclass IIIe and Loamy Sand range site.

9—Cisco fine sandy loam, 1 to 5 percent slopes. This deep, gently sloping soil is on uplands. Slopes are convex and average about 2.5 percent. This soil is on long, narrow terraces along creeks and larger drainageways.

Typically, the surface layer is brown fine sandy loam about 9 inches thick. The subsoil extends to a depth of 50 inches. It is slightly acid, reddish brown sandy clay loam to a depth of 20 inches; neutral, red sandy clay loam to a depth of 36 inches; and moderately alkaline, red sandy clay loam to a depth of 50 inches. The substratum is moderately alkaline, yellowish red fine sandy loam.

This soil is well drained. Surface runoff is slow to medium. Permeability is moderate, and available water capacity is medium. The hazards of water erosion and soil blowing are moderate. The shrink-swell potential of the subsoil is moderate.

Included with this soil in mapping are small areas of Stoneburg, Bluegrove, Kirkland, Anocon, and Renfrow soils. These soils make up less than 10 percent of any mapped area.

This Cisco soil is suitable for cultivation, but it is used mainly for rangeland.

This soil has high potential for native range plants and for wildlife habitat. Tall and mid grasses, forbs, and oak trees are the main native vegetation. Proper stocking, controlled grazing, and brush management are needed.

The potential is medium for cultivated crops. Crop residue left on or near the surface helps to conserve soil moisture and maintain tilth and productivity. Use of residue also helps to control soil blowing. Terracing and contour farming help to control water erosion.

This soil has high potential for improved pasture production. King Ranch bluestem, coastal bermudagrass, weeping lovegrass, and kleingrass grow well in this soil. Controlled grazing, weed control, and timely application of fertilizer increase the quantity of high quality forage.

Potential is medium for most urban and recreation uses. Shrinking and swelling properties, low strength, and slope are the main limitations. Slope can limit some recreation uses.

This soil is in capability subclass IIIe and Sandy Loam range site.

10—Darnell-Truce complex, 3 to 12 percent slopes. These shallow and deep, gently sloping to strongly sloping soils are on upland ridges. Slopes are convex. Areas are 25 to 300 acres.

Darnell soils make up about 50 percent of the complex; Truce soils, about 30 percent; and other soils, 20 percent. The shallow Darnell soil is on ridgetops and upper side slopes. The deep Truce soil is on lower side slopes. These soils are so intricately mixed that separation is not practical at the scale used in mapping.

Typically, the Darnell soil (fig. 4) has a surface layer of very friable, medium acid, brown fine sandy loam about 6 inches thick. The subsoil is medium acid, reddish yellow fine sandy loam about 8 inches thick. The underlying material is weakly cemented sandstone.

The Darnell soil is well drained to somewhat excessively drained. Surface runoff is medium to rapid. Permeability is moderately rapid, and available water capacity is very low. The hazard of soil blowing is moderate, and the hazard of water erosion is severe. The shrink-swell potential is low.

Typically, the Truce soil has a surface layer of friable, slightly acid, brown, stony fine sandy loam about 6 inches thick. Sandstone fragments cover 15 to 25 percent of the surface. The subsoil extends to a depth of 45 inches. It is mildly alkaline, reddish brown clay to a depth of 17 inches; mildly alkaline, brown clay to a depth of 24 inches; moderately alkaline, calcareous, light yellowish brown clay to a depth of 38 inches; and moderately alkaline, calcareous, light olive gray clay to a depth of 45 inches. The underlying material is light olive gray clayey shale.

The Truce soil is well drained. Surface runoff is rapid. Permeability is slow, and available water capacity is

Figure 4.—Profile of Darnell fine sandy loam. Sandstone is at a depth of about 18 inches.

medium. The hazard of soil blowing is moderate, and the hazard of water erosion is severe. The shrink-swell potential is moderate.

Included with these soils in mapping are Nebgen soils on ridgetops. Outcrops of sandstone occur in small areas on some side slopes. These soils and outcrops make up about 20 percent of the complex.

Nearly all areas of this Darnell-Truce complex are used for range. Because of slope and stoniness, these soils are not suited to cultivated crops or improved pasture.

These soils have medium potential for native range plants and for wildlife habitat.

Potential is low for most urban and recreation uses. Slope, depth to bedrock, shrinking and swelling properties, and stones on the surface are limitations.

This complex is in capability subclass VIe and Sandstone Hills range site.

11—Deandale silt loam, 0 to 1 percent slopes. This deep, nearly level soil is on uplands. Surfaces are plane, and slopes are dominantly less than 0.5 percent. Areas range from 50 to several hundred acres.

Typically, the surface layer is slightly acid, grayish brown silt loam about 9 inches thick. The subsoil extends to a depth of 80 inches. It is moderately alkaline, dark brown clay to a depth of 23 inches; moderately alkaline, calcareous brown clay to a depth of 54 inches; and moderately alkaline, calcareous, yellowish red clay to a depth of 80 inches (fig. 5).

Figure 5.—Profile of Deandale silt loam, showing abrupt texture change at a depth of about 10 inches. The surface layer is silt loam, and the subsoil is clay.

This soil is moderately well drained. Surface runoff is slow. Permeability is very slow, and available water capacity is high. The hazards of water erosion and soil blowing are slight. During prolonged wet periods, the surface layer is saturated. The shrink-swell potential is high.

Included with this soil in mapping are small areas of Kamay soils and Renfrow soils. These soils are on higher lying slopes than the Deandale soil. Also included are small areas of Kirkland soils. The included soils make up as much as 15 percent of a mapped area.

Most areas of this Deandale soil are in cropland. Some areas are in range.

This soil has medium potential for native range plants and for wildlife habitat. Short grasses are the main native vegetation.

This soil has high potential for wheat and other small grain. The potential is medium for warm-season crops because the soil is droughty. Leaving crop residue on the surface, timely and limited tillage, and rotation of crops help to control soil blowing and water erosion and to conserve soil moisture. Use of residue also helps to maintain productivity and tilth. If crop growth and residue do not produce adequate cover, emergency tillage is occasionally needed to roughen the surface. Roughening helps to reduce damage by soil blowing. Timely application of fertilizer increases yield.

The potential is medium for improved pasture grasses, such as kleingrass and bermudagrass. Weed control, proper grazing, and fertilizer are needed to produce high quality and quantity of forage.

Potential is low for most urban and recreation uses. Very slow permeability, shrinking and swelling properties, low strength, and corrosivity to uncoated steel are limitations.

This soil is in capability subclass IIs and Claypan Prairie range site.

12—Deandale silt loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands. Slopes are plane. Areas range from 50 to several hundred acres.

Typically, the surface layer is brown silt loam about 12 inches thick. The subsoil extends to a depth of 80 inches. To a depth of 46 inches, it is moderately alkaline, dark brown clay that is noncalcareous in the upper part and calcareous in the lower part; to a depth of 66 inches, it is moderately alkaline, calcareous, reddish brown clay. Between depths of 66 and 80 inches, the subsoil is moderately alkaline, calcareous, yellowish red clay.

This soil is moderately well drained. Surface runoff is slow to medium. Permeability is very slow, and available water capacity is high. The hazard of soil blowing is slight, and the hazard of water erosion is slight to moderate. The shrink-swell potential is high.

Included with this soil in mapping are narrow areas of Port soils at the bottom of drainageways. Also included are small areas of Winters soils. The included soils make up as much as 10 percent of a mapped area.

Most areas of this Deandale soil are cultivated. Small grain is the main crop.

This soil has medium potential for crops. It is droughty because of the very slow permeability. Leaving crop residue on the surface, timely and limited tillage, rotation of crops, terracing, and contour farming help to control soil blowing and to conserve soil moisture. Use of residue also helps to maintain productivity and tilth. Emergency tillage is occasionally needed to roughen the surface. Roughening helps to reduce damage by soil blowing if crop growth and residue do not produce adequate cover. Timely application of fertilizer increases yield.

The potential is medium for improved pasture grasses, such as kleingrass and bermudagrass. Weed control, proper grazing, and fertilizer are needed to produce high quality and quantity of forage.

This soil has medium potential for native range plants and for wildlife habitat. Short grasses are the main native vegetation.

Potential is low for most urban and recreation uses. Corrosivity to uncoated steel, very slow permeability, shrinking and swelling properties, and low strength are limitations.

This soil is in capability subclass IIIe and Claypan Prairie range site.

13—Devol loamy fine sand, 0 to 3 percent slopes. This deep, nearly level to gently sloping soil has short slopes. Surfaces are weakly undulating. Areas are about 900 acres.

Typically, the surface layer is slightly acid, light brown loamy fine sand about 13 inches thick. The subsoil extends to a depth of 55 inches. It is reddish brown fine sandy loam that is neutral to a depth of 32 inches and mildly alkaline to a depth of 55 inches. The substratum is mildly alkaline, yellowish red loamy fine sand.

This soil is well drained. Surface runoff is very slow. Permeability is moderately rapid, and available water capacity is medium. The hazard of soil blowing is severe because of the sandy surface layer. The hazard of water erosion is slight. The shrink-swell potential is low.

Included with this soil in mapping are small areas of Grandfield fine sandy loam and Devol fine sandy loam that make up as much as 10 percent of some mapped areas.

Most areas of this Devol soil are used for pasture or orchards. Tall and mid grasses are the native vegetation.

This soil has medium potential for cultivated crops. Leaving crop residue on the surface, timely and limited tillage, and rotation of crops help to control soil blowing and water erosion and to conserve soil moisture. The use of residue also helps to maintain productivity. Timely application of fertilizer increases yield.

The potential is high for improved pasture grasses, such as bermudagrass and lovegrass. Weed control, proper grazing, and fertilizer are needed to produce high quality and quantity of forage.

This soil has high potential for native range plants. Tall and mid grasses are the main native vegetation. The potential is medium for wildlife habitat.

Potential is high for most urban uses. Protection from wind damage is needed during construction of buildings and streets. Low strength is a limitation for local roads and streets. Potential is medium for recreation uses. The sandy surface layer is a limitation.

This soil is in capability subclass IIIe and Loamy Sand range site.

14—Devol loamy fine sand, 3 to 8 percent slopes. This deep, gently sloping to sloping soil has short slopes. Surfaces are weakly undulating.

Typically, the surface layer is brown loamy fine sand about 14 inches thick. The subsoil to a depth of 50 inches is neutral to mildly alkaline, reddish brown fine sandy loam. The substratum is mildly alkaline, yellowish red loamy fine sand.

This soil is well drained. Surface runoff is very slow. Permeability is moderately rapid, and available water capacity is medium. The hazard of soil blowing is severe, and the hazard of water erosion is moderate. The shrink-swell potential is low.

Included with this soil in mapping are small areas of Grandfield soils, which make up as much as 15 percent of a mapped area.

Most areas of this Devol soil are used for improved pasture. The rest is used for range, or it is in cultivated crops.

This soil has low potential for cultivated crops. Slope and the hazard of soil blowing are limitations. Leaving crop residue on the surface, timely and limited tillage, and rotation of crops help to control soil blowing and water erosion and to conserve soil moisture. Timely application of fertilizer increases yield.

The potential is high for improved pasture grasses, such as bermudagrass and lovegrass. Weed control, proper grazing, and fertilizer are needed to maintain high quality and quantity of forage.

This soil has high potential for native range plants. Tall and mid grasses are the main vegetation. The potential is medium for wildlife habitat.

Potential is medium for urban and recreation uses. Slope and the sandy surface layer are limitations. Low strength is a limitation for local roads and streets.

This soil is in capability subclass IVe and Loamy Sand range site.

15—Devol fine sandy loam, 0 to 1 percent slopes. This deep, nearly level soil is on uplands. Areas average about 700 acres.

Typically, the surface layer is slightly acid, yellowish brown fine sandy loam about 8 inches thick. The subsoil is neutral, brown fine sandy loam to a depth of 32 inches. Below that layer, the subsoil and substratum are mildly alkaline, brown and yellowish red fine sandy loam.

This soil is well drained. Surface runoff is very slow. Permeability is moderately rapid, and available water capacity is medium. The hazard of soil blowing is moderate, and the hazard of water erosion is slight. The shrink-swell potential is low.

Included with this soil in mapping are spots of Teller soils in lower, slightly depressional areas. Also included are small areas of Enterprise soils on higher, convex ridges. These soils make up as much as 15 percent of a mapped area.

Most areas of this Devol soil are used for cultivated crops.

This soil has medium potential for cultivated crops. Leaving crop residue on the surface, timely and limited tillage, and crop rotation help to control soil blowing and water erosion and to conserve soil moisture. The use of residue also helps to maintain productivity. Emergency tillage is occasionally needed to roughen the surface. Roughening helps to reduce the damage from soil blowing if crop growth and residue do not produce adequate cover. Timely application of fertilizer increases yield.

The potential is high for improved pasture grasses, such as bermudagrass and lovegrass. Weed control, proper grazing, and fertilizer increase the yield of high quality forage.

This soil has high potential for native range plants. Tall and mid grasses are the main vegetation. The potential is medium for wildlife habitat.

Potential is high for most urban and recreation uses. Low strength is a limitation for local roads and streets.

This soil is in capability subclass IIe and Sandy Loam range site.

16—Devol fine sandy loam, 1 to 3 percent slopes. This deep, nearly level soil is on uplands. Areas average about 220 acres.

Typically, the surface layer is slightly acid, light brown fine sandy loam about 6 inches thick. The subsoil is neutral to mildly alkaline, brown fine sandy loam to a depth of 53 inches. The substratum is mildly alkaline, brown sandy clay loam.

This soil is well drained. Surface runoff is very slow. Permeability is moderately rapid, and available water capacity is medium. The hazard of soil blowing is moderate, and the hazard of water erosion is slight to moderate. The shrink-swell potential is low.

Included with this soil in mapping are small areas of Enterprise soils on the higher, more convex ridges. Also included are lower lying areas of Teller soils, which have concave slopes. The included soils make up as much as 10 percent of each mapped area.

Most areas of this Devol soil are used for cultivated crops.

This soil has medium potential for cultivated crops. Leaving crop residue on the surface, timely and limited tillage, and crop rotation help to control soil blowing and water erosion and to conserve soil moisture. Use of residue also helps to maintain productivity. Emergency tillage is occasionally needed to roughen the soil

surface. Roughening helps to reduce damage from soil blowing if crop growth and residue do not produce adequate cover. Timely application of fertilizer increases yield.

The potential is high for improved pasture grasses, such as bermudagrass and lovegrass. Weed control, proper grazing, and fertilizer are needed to increase the yield of high quality forage.

This soil has high potential for native range plants. Mid and tall grasses are the main native vegetation. The potential is medium for wildlife habitat.

Potential is medium for most urban and recreation uses. Low strength is a limitation for local roads and streets. Slope is a limitation for some recreation uses.

This soil is in capability subclass IIIe and Sandy Loam range site.

17—Duffau loamy fine sand, 1 to 5 percent slopes. This deep, gently sloping soil is on uplands. Slopes are smooth and average about 2 percent. Areas range from 20 to 200 acres.

Typically, the surface layer is slightly acid, brown loamy fine sand about 7 inches thick. The subsurface layer is neutral, light brown loamy fine sand. The subsoil is neutral sandy clay loam to a depth of 68 inches. It is reddish brown in the upper part, yellowish red in the middle part, and reddish yellow in the lower part. The substratum is mildly alkaline, reddish yellow fine sandy loam (fig. 6).

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is medium. The hazard of soil blowing is severe, and the hazard of water erosion is slight to moderate. The root zone is deep and is easily penetrated by roots. The shrink-swell potential is low.

Included with this soil in mapping are small areas of Windthorst soils and areas of duned or mounded soils that are similar to this Duffau soil but have a sandy surface layer thicker than 20 inches. Also included are a few areas of Duffau soil that have slopes ranging to 6 percent. The included soils make up as much as 15 percent of a mapped area.

This Duffau soil has limited use for cultivated crops. It is used mainly for rangeland.

This soil has high potential for native plants and for upland wildlife habitat. A mixture of tall and mid grasses, forbs, and oak trees make up the native plant community. Proper stocking, controlled grazing, and brush management are needed.

The potential is medium for selected crops, for example, small grain and sorghum. Leaving crop residue on the surface helps to protect the soil from blowing and from water erosion. The use of residue also conserves soil moisture and helps maintain tilth. Terracing and contour farming are needed in some areas to control water erosion. The timely application of fertilizer is needed to maintain yield and soil fertility.

Figure 6.—Profile of Duffau loamy fine sand.

This soil has high potential for improved pasture production. Improved grasses, such as coastal bermudagrass, weeping lovegrass, and kleingrass, grow well in this soil. Weed control, controlled grazing, and fertilizer are needed to maintain maximum production of high quality forage.

Potential is medium to high for urban and recreation uses. The sandy surface layer is the main limitation. Low strength is a limitation for local roads and streets.

This soil is in capability subclass IIIe and Loamy Sand range site.

18—Enterprise very fine sandy loam, 0 to 1 percent slopes. This deep, nearly level soil is on uplands. Slopes are plane to slightly convex and average about 0.5 percent. Areas average 190 acres.

Typically, the surface layer is neutral, brown very fine sandy loam about 9 inches thick. The subsurface layer is neutral, reddish brown very fine sandy loam about 21 inches thick. The subsoil is moderately alkaline, reddish yellow very fine sandy loam to a depth of 66 inches. The substratum is moderately alkaline, reddish yellow very fine sandy loam.

This soil is well drained. Surface runoff is slow. Permeability is moderately rapid, and available water capacity is high. The hazard of soil blowing is moderate, and the hazard of water erosion is slight. The shrink-swell potential is low.

Included with this soil in mapping are small areas of Devol soils and Teller soils that make up as much as 15 percent of a mapped area.

Most areas of this Enterprise soil are used for cultivated crops.

This soil has high potential for cultivated crops. Leaving crop residue on the surface, timely and limited tillage, and rotation of crops help to control soil blowing and water erosion and to conserve soil moisture. The use of residue also helps to maintain productivity. Emergency tillage is occasionally needed to roughen the surface. Roughening helps to reduce damage from soil blowing if crop growth and residue do not produce adequate cover. Timely application of fertilizer increases yield.

The potential is high for improved pasture grasses, such as bermudagrass and kleingrass. Weed control, proper grazing, and fertilizer are needed to help maintain a high quantity of high quality forage.

This soil has high potential for native range plants and for wildlife habitat. Mid grasses are the main native vegetation.

Potential is high for urban and recreation uses. Low strength is a moderate limitation for local roads and streets.

This soil is in capability subclass IIc and Sandy Loam range site.

19—Enterprise very fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands. Slopes are convex. Areas average 190 acres, but they range from 50 to several hundred acres.

Typically, this soil is very fine sandy loam to a depth of about 80 inches. It is neutral and reddish brown in the upper part and grades to moderately alkaline and reddish yellow in the lower part.

This soil is well drained. Surface runoff is slow. Permeability is moderately rapid, and available water capacity is high. The hazard of soil blowing is moderate, and the hazard of water erosion is slight to moderate. The shrink-swell potential is low.

Included with this soil in mapping are small areas of Devol soils which make up less than 15 percent of any mapped area.

Most areas of this Enterprise soil are cultivated.

This soil has high potential for cultivated crops. Leaving crop residue on the surface, timely and limited tillage, rotation of crops, terracing, and contour farming help to control soil blowing and water erosion and to conserve soil moisture. The use of residue also helps to maintain productivity. Emergency tillage is occasionally needed to roughen the surface. Roughening helps to reduce damage from soil blowing if crop growth and residue do not produce adequate cover. Timely application of fertilizer increases yield.

The potential is high for improved pasture grasses, such as bermudagrass and kleingrass. Weed control, proper grazing, and fertilizer are needed.

This soil has high potential for native range plants and for wildlife habitat. Mid grasses are the main native vegetation.

Potential is high for most urban and recreation uses. Low strength is a limitation for local roads and streets. Slope limits some recreation use.

This soil is in capability subclass IIe and Sandy Loam range site.

20—Enterprise very fine sandy loam, 3 to 5 percent slopes. This deep, gently sloping soil is on uplands. Slopes are convex. Areas average about 40 acres, but they range from 25 to 100 acres.

Typically, this soil is very fine sandy loam to a depth of 80 inches. It is brown in the upper part, reddish brown in the next part, and reddish yellow in the lower part. It is neutral in the upper part and grades to moderately alkaline in the lower part.

This soil is well drained. Surface runoff is medium. Permeability is moderately rapid, and available water capacity is high. The hazards of soil blowing and water erosion are moderate. The shrink-swell potential is low.

Included with this soil in mapping are small areas of Devol soil which makes up less than 10 percent of a mapped area.

About 50 percent of this Enterprise soil is cultivated.

This soil has medium potential for cultivated crops. Slope is a limitation for cultivation. Leaving crop residue on the surface, timely and limited tillage, rotation of crops, terracing, and contour farming help to control soil blowing and water erosion and to conserve soil moisture. The use of residue also helps to maintain productivity. Emergency tillage is occasionally needed to roughen the surface. Roughening helps to reduce damage from soil blowing if crop growth and residue do not produce adequate cover. Timely application of fertilizer increases yield.

Potential is high for improved pasture grasses, such as bermudagrass and lovegrass. Weed control, proper grazing, and fertilizer are needed.

This soil has high potential for native range plants and for wildlife habitat. Mid grasses are the main native vegetation.

The potential is high for urban and recreation uses. Low strength is a limitation for local roads and streets. Slope can limit some recreation uses.

This soil is in capability subclass IIIe and Sandy Loam range site.

21—Enterprise very fine sandy loam, 5 to 8 percent slopes. This deep, sloping soil is on uplands. Slopes are convex. Areas average 175 acres, but they range from 20 to 200 acres.

Typically, this soil is very fine sandy loam to a depth of 80 inches. It is reddish brown in the upper part, yellowish red in the next part, and reddish yellow in the lower part. It is neutral in the upper part and grades to moderately alkaline in the lower part.

This soil is well drained. Surface runoff is medium. Available water capacity is high, and permeability is moderately rapid. The hazard of soil blowing is moderate, and the hazard of water erosion is severe. The shrink-swell potential is low.

Included with this soil in mapping are small areas of gently sloping and strongly sloping Enterprise soils and small areas of Devol soils. The included soils make up as much as 10 percent of a mapped area.

Most areas of this Enterprise soil are used for range.

This soil has low potential for cultivated crops. Slope limits the use of equipment and the type of crops that can be grown to protect the soil. Leaving crop residue on the surface, timely and limited tillage, crop rotation, and terracing and contour farming help to control soil blowing and water erosion and to conserve soil moisture. The use of residue also maintains productivity. Emergency tillage is occasionally needed to roughen the surface. Roughening helps to reduce damage from soil blowing if crop growth and residue do not produce adequate cover.

The potential is medium for improved pasture grasses, such as bermudagrass and lovegrass. Slope limits production. Weed control, proper grazing, and fertilizer are needed.

This soil has high potential for native range plants and for wildlife habitat. Mid grasses are the main native vegetation.

Potential is high for most urban and recreation uses. Low strength is a limitation for local roads and streets. Slope limits some recreation uses.

This soil is in capability subclass IVe and Sandy Loam range site.

22—Enterprise very fine sandy loam, 8 to 20 percent slopes. This deep, strongly sloping and moderately steep soil is on uplands. Areas are along the Red River on side slopes between the erosional uplands and the Red River bottom lands. They are 100 to 300 feet wide, and some areas are several miles long. Slopes are convex. Spots of sandstone bedrock outcrop are in about 80 percent of the areas. These spots are generally in the lower part of the map unit.

Typically, this soil is very fine sandy loam to a depth of 80 inches. It is brown in the upper part, reddish brown in the next part, and reddish yellow in the lower part. It is neutral in the upper part and grades to moderately alkaline in the lower part.

This soil is well drained. Surface runoff is medium. Permeability is moderately rapid, and available water capacity is high. The hazard of soil blowing is moderate, and the hazard of water erosion is severe. The shrink-swell potential is low.

Included with this soil in mapping are small areas of Devol soils and Minco soils which make up as much as 10 percent of some mapped areas.

Most areas of this Enterprise soil are used for range. The soil is not suitable for cultivated crops or improved pasture grasses because of slope.

This soil has high potential for native range plants and for wildlife habitat. Sand dropseed, tumble windmillgrass, little bluestem, and annual weeds are the main native vegetation.

Potential is low for most urban and recreation uses. Slope and low strength are limitations.

This soil is in capability subclass VIe and Sandy Loam range site.

23—Gowen soils, frequently flooded. These deep soils are on flood plains of creeks and along larger drainageways in the southern part of the county. Slopes range from 0 to 1 percent.

The surface layer of these soils is loam, clay loam, sandy clay loam, or fine sandy loam. The varied textures are so intermixed and the areas are so small that the soils cannot be separated at the scale used in mapping.

Typically, the surface layer is brown loam about 15 inches thick. The next layer is brown sandy clay loam about 9 inches thick. The substratum is brown loam stratified with fine sandy loam. Reaction is neutral throughout the profile.

These soils are well drained. Surface runoff is slow. Flooding occurs in about 3 years in 5; however, about 20 percent of the soil is flooded every year. Permeability is moderate, and available water capacity is high. The hazard of erosion is slight. The shrink-swell potential is moderate.

Included with these soils in mapping are small areas of Port soils, meandering drainageways 3 to 10 feet deep, and narrow bands of sandier soils adjacent to the drainageways. The included soils make up as much as 20 percent of a mapped area.

Most areas of these Gowen soils are used for range.

These soils have low potential for cultivated crops because of the hazard of flooding and the smallness of areas that can be farmed. However, a few areas that have less probability of being flooded are large enough to be farmed. They make up less than 10 percent of any mapped area.

The potential is high for pasture grasses, such as kleingrass and lovegrass. Weed control, proper grazing, and fertilizer are needed to increase the productivity of high quality forage.

These soils have high potential for native range plants and for wildlife habitat. Tall and mid grasses are the main native vegetation.

Potential is low for urban and recreation uses. Flooding is the main limitation.

These soils are in capability subclass Vw and Loamy Bottomland range site.

24—Grandfield loamy fine sand, 0 to 3 percent slopes. This deep, nearly level to gently sloping soil is on uplands. Surfaces are weakly undulating.

Typically, the surface layer is slightly acid, brown loamy fine sand about 10 inches thick. The subsoil extends to a depth of 80 inches. To a depth of 51 inches, it is slightly acid, reddish brown sandy clay loam that grades to reddish yellow in the lower part; to a depth of 80 inches, it is neutral, reddish yellow fine sandy loam.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is medium. The hazard of soil blowing is moderate to severe, and the hazard of water erosion is slight. The shrink-swell potential is low.

Included with this soil in mapping are small areas of Grandfield fine sandy loam and Devol loamy fine sand which make up as much as 15 percent of the mapped areas.

This Grandfield soil is used for cultivated crops, orchards, and range.

This soil has medium potential for wheat, grain sorghum, and cotton. Leaving crop residue on the surface, timely and limited tillage, rotation of crops, and timely application of fertilizer help to control soil blowing and water erosion, conserve soil moisture, and maintain productivity. Emergency tillage is occasionally needed to roughen the surface. Roughening helps to reduce soil blowing if crop growth and residue do not produce adequate cover.

The potential is high for improved pasture grasses, such as bermudagrass and weeping lovegrass. Weed control, controlled grazing, and fertilizer help to increase the quantity and improve the quality of forage.

This soil has medium potential for orchards. Use of cover crops, leaving crop residue on the surface, and timely application of fertilizer help to control soil blowing and water erosion and to maintain productivity.

The potential is high for native range plants and for wildlife habitat. Mid and tall grasses are the main native vegetation.

Potential is high for most urban uses. Low strength is a limitation for local roads and streets. Potential is medium for recreation uses. The sandy surface layer is a limitation.

This soil is in capability subclass IIIe and Loamy Sand range site.

25—Grandfield fine sandy loam, 1 to 5 percent slopes. This deep, gently sloping to undulating soil is on uplands. Slopes are convex. Areas are adjacent to tributaries of larger creeks and streams of the county. They are long and range from 200 to 1,000 feet in width.

Typically, the surface layer is slightly acid, reddish brown fine sandy loam about 7 inches thick. The subsoil extends to a depth of 80 inches. It is neutral, reddish brown sandy clay loam to a depth of 22 inches; neutral, red sandy clay loam to a depth of 40 inches; and moderately alkaline, light red fine sandy loam to a depth of 80 inches.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is medium. The hazards of soil blowing and water erosion are moderate. The shrink-swell potential is low.

Included with this soil in mapping are small areas of Vernon, Devol, and Bluegrove soils. Also included are small areas of soils that are similar to this Grandfield soil but are underlain with shale or sandstone between a depth of 50 and 60 inches. The included soils make up as much as 20 percent of the mapped areas.

Most areas of this Grandfield soil are used for range.

This soil has medium potential for cultivated crops. Leaving crop residue on the surface, timely and limited tillage, rotation of crops, terracing, and contour farming help to control soil blowing and water erosion and to conserve soil moisture. Use of residue also helps to maintain productivity. Emergency tillage is occasionally needed to roughen the surface. Roughening helps to reduce damage from soil blowing if crop growth and residue do not produce adequate cover. Timely application of fertilizer increases yield.

The potential is high for improved pasture grasses, such as bermudagrass, kleingrass, and lovegrass. Weed control, proper grazing, and fertilizer are needed to increase production of high quality forage.

This soil has high potential for native range plants and for wildlife habitat. Mid and tall grasses are the main native vegetation.

Potential is high for most urban and recreation uses. Low strength is a limitation for local roads and streets.

This soil is in capability subclass IIIe and Sandy Loam range site.

26—Kamay silt loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands. Slopes are plane. Areas average about 300 acres, but they range from 30 to about 1,000 acres.

Typically, the surface layer is slightly acid, brown silt loam about 9 inches thick. The subsoil extends to a depth of 63 inches. It is mildly alkaline to moderately alkaline, brown clay to a depth of 36 inches and moderately alkaline, yellowish red clay to a depth of 63 inches. The underlying material is interbedded, red and gray clayey shale.

This soil is well drained. Surface runoff is medium. Permeability is very slow, and available water capacity is high. The hazard of soil blowing is slight, and the hazard of water erosion is moderate. The shrink-swell potential is high.

Included with this soil in mapping are somewhat depressional areas of Deandale soils that are less sloping than this Kamay soil. Also included are areas of Bluegrove soils that have convex slopes and small areas

of Renfrow soils. The included soils make up as much as 15 percent of a mapped area.

Most areas of this Kamay soil are used for range.

This soil has high potential for small grain such as wheat. Because the soil is very slowly permeable, it is droughty for warm-season crops. Leaving crop residue on the surface, timely and limited tillage, crop rotation, terracing, and contour farming help to control soil blowing and water erosion and to conserve soil moisture. The use of residue also helps to maintain productivity and tilth. Timely application of fertilizer increases yield.

The potential is medium for improved pasture grasses, such as bermudagrass and kleingrass. Weed control, proper grazing, and fertilizer increase the quantity of high quality forage.

This soil has medium potential for native range plants and for wildlife habitat. Short grasses that produce a medium amount of forage are the main native vegetation.

Potential is low for most urban and recreation uses. Corrosivity to uncoated steel, very slow permeability, high shrinking and swelling properties, low strength, and a high content of clay are limitations.

This soil is in capability subclass IIIe and Claypan Prairie range site.

27—Kirkland silt loam, 0 to 1 percent slopes. This deep, nearly level soil is on uplands. Surfaces are smooth. Areas average about 100 acres, but they range from 50 to several hundred acres.

Typically, the surface layer is silt loam about 12 inches thick. It is slightly acid and grayish brown in the upper part and neutral and dark grayish brown in the lower part. The subsoil extends to a depth of 80 inches. It is neutral to moderately alkaline, dark grayish brown clay to a depth of 34 inches; moderately alkaline, dark brown clay to a depth of 66 inches; and moderately alkaline, yellowish red clay to a depth of 80 inches.

This soil is well drained. Surface runoff is slow. Permeability is very slow, and available water capacity is high. The hazards of soil blowing and water erosion are slight. The shrink-swell potential is high.

Included with this soil in mapping are small areas of gently sloping Deandale soils and Renfrow soils. Also included are small areas of Waurika soils. The included soils make up as much as 20 percent of mapped areas.

Most areas of this Kirkland soil are used for range.

This soil has high potential for wheat and other cool-season crops. It has medium potential for cotton and grain sorghum because it is somewhat droughty. Leaving crop residue on the surface, timely and limited tillage, and crop rotation help to control soil blowing and water erosion and to conserve soil moisture. Use of residue also helps to maintain productivity and tilth. Emergency tillage is occasionally needed to roughen the soil surface. Roughening helps to reduce damage from soil blowing if crop growth and residue do not produce adequate cover. Timely application of fertilizer increases yield.

The potential is medium for improved pasture grasses, such as bermudagrass and kleingrass. Weed control, proper grazing, and fertilizer help to increase the quantity and improve quality of forage.

This soil has medium potential for native range plants and for wildlife habitat. Short grasses are the main vegetation.

Potential is low for most urban and recreation uses. Very slow permeability, low strength, shrinking and swelling properties, and corrosivity to uncoated steel are limitations.

This soil is in capability subclass IIs and Claypan Prairie range site.

28—Knoco-Owens association, undulating. These shallow and very shallow soils are on uplands. Slopes range from 1 to 8 percent. Areas are irregular in shape and range from 15 to 200 acres.

Knoco soils make up about 40 percent of this association and Owens soils about 30 percent. Other soils and areas of badland make up 30 percent. Knoco soils are generally on the more sloping parts of the association and are intermixed with spots and patches of badland. Owens soils are on the less sloping parts. The composition of this map unit is more varied than that of other map units in Clay County. The soils are not in a uniform pattern. However, mapping has been controlled well enough for the anticipated use of the area.

Typically, the Knoco soil has a surface layer of very firm, moderately alkaline, calcareous, reddish brown clay about 5 inches thick. The underlying material is firm, calcareous, red clayey shale.

The Knoco soil is excessively drained. Surface runoff is rapid. Permeability is very slow, and available water capacity is very low. The hazard of water erosion is severe, and the hazard of soil blowing is slight. The shrink-swell potential is high.

Typically, the Owens soil has a surface layer of very firm, moderately alkaline, calcareous, reddish brown clay about 6 inches thick. The subsoil is very firm, moderately alkaline, calcareous, brown clay to a depth of 15 inches. The underlying material is very firm, calcareous, gray and red clayey shale.

The Owens soil is well drained. Surface runoff is rapid. Permeability is very slow, and available water capacity is very low. The hazard of water erosion is severe, and the hazard of soil blowing is slight. The shrink-swell potential is high.

Included with these soils in mapping are areas of Vernon, Kamay, and Renfrow soils; small areas of strongly sloping to steep Knoco and Owens soils; and areas of badland. The areas of badland, which consist of barren, exposed clayey shale, make up about 10 percent of the association. The other included soils make up about 20 percent.

This Knoco-Owens association is not suitable for cultivation or improved pasture. Depth of soil, slope, and the hazard of erosion are limitations.

These soils have low potential for native range plants and for wildlife habitat. Depth of the root zone limits growth of vegetation.

Potential is low for urban and recreation uses. Depth of soil, slope, very slow permeability, and shrinking and swelling properties are limitations.

This association is in capability subclass VIIs and Shallow Clay range site.

29—Lincoln fine sandy loam, frequently flooded. This deep, gently undulating soil is on flood plains (fig. 7). Slopes range from 0 to 3 percent. Areas are from 25 to 200 acres.

Typically, this soil has a surface layer of reddish brown fine sandy loam about 10 inches thick. The substratum is loose, reddish yellow fine sand. The soil is moderately alkaline and calcareous throughout.

This soil is somewhat excessively drained. Surface runoff is slow. Permeability is rapid, and available water capacity is low. The hazard of soil blowing is severe, and the hazard of water erosion is slight. The shrink-swell potential is low. These soils are flooded on an average of about 3 times in 5 years.

Included with this soil in mapping are small areas of Tivoli fine sand on high ridges. Also included are lower lying areas of Yomont soils and small areas of Lincoln soils that have a surface layer of loamy fine sand, sandy clay loam, silt loam, or clay. The included soils make up as much as 20 percent of a mapped area.

Most areas of this Lincoln soil are used for range. A few areas are used for improved pasture. The soil is not suitable for cultivation because of the hazards of flooding and soil blowing.

The potential is high for improved pasture grasses, such as bermudagrass and lovegrass. Weed control, proper grazing, and fertilizer improve the quality and increase the quantity of forage.

This soil has medium potential for native range plants and for wildlife habitat. Tall grasses are the main native vegetation.

Figure 7.—Area of Lincoln fine sandy loam. This soil is in Sandy Bottomland range site.

Potential is low for most urban and recreation uses. Flooding and the sandy texture of the soil are the main limitations.

This soil is in capability subclass Vw and Sandy Bottomland range site.

30—Mangum silty clay loam, occasionally flooded. This deep, nearly level soil is on bottom land areas on flood plains of the Wichita River. Slopes are less than 0.5 percent. Areas range from 50 to several hundred acres.

Typically, the surface layer is moderately alkaline, calcareous, reddish brown silty clay loam about 10 inches thick. The substratum is moderately alkaline, calcareous, reddish brown clay to a depth of 60 inches.

This soil is moderately well drained. Surface runoff is slow. This soil is flooded once about every 3 to 5 years. Permeability is very slow, and available water capacity is high. The hazards of soil blowing and water erosion are slight. The shrink-swell potential is high.

Included with this soil in mapping are small, lower lying depressional areas of Mangum clay and irregularly shaped areas of Weswood soils. The included soils make up as much as 10 percent of the mapped areas.

About 80 percent of the areas of this Mangum soil is cultivated. Wheat is the main crop.

This soil has high potential for wheat or other small grain and medium potential for grain sorghum, cotton, or other warm-season crops because it is somewhat droughty. Leaving crop residue on the surface, timely and limited tillage, and rotation of crops help to control soil blowing and water erosion and to conserve soil moisture. The use of residue also helps to maintain productivity and tilth. Emergency tillage is occasionally needed to roughen the surface. Roughening helps to control soil blowing if crop growth and residue do not produce adequate cover. Timely application of fertilizer increases yield.

The potential is medium for improved pasture grasses. This soil is droughty for warm-season crops. Weed control, controlled grazing, and fertilizer help to increase the quantity and improve the quality of forage.

This soil has medium potential for native range plants and for wildlife habitat. Short grasses are the main native vegetation.

Potential is low for most urban and recreation uses. The hazard of flooding, shrinking and swelling properties, and very slow permeability are limitations.

This soil is in capability subclass IIw and Draw range site.

31—Mangum clay, occasionally flooded. This deep, nearly level soil is on bottom lands. It is on the flood plains of the Little Wichita River below Lake Arrowhead Dam.

Typically, this soil is very firm, moderately alkaline, calcareous, reddish brown clay to a depth of 60 inches.

This soil is moderately well drained. Surface runoff is very slow. Permeability is very slow, and available water capacity is high. This soil is flooded once in about every 3 to 5 years. The hazards of soil blowing and water erosion are slight. The shrink-swell potential is high. This soil is droughty.

Included with this soil in mapping are small areas of Ships clay in swales and microbasins and areas of Weswood soils adjacent to stream channels. The included soils make up as much as 15 percent of a mapped area.

Most areas of this Mangum soil are used for range. The rest is used for cultivated crops and pasture.

This soil has low potential for cultivated crops. It is droughty because of the clayey texture. If crops are grown, the soil is best suited to small grain. Leaving crop residue on the surface, timely and limited tillage, and rotation of crops help to control water erosion and to conserve soil moisture. The use of residue also helps to maintain productivity and tilth.

The potential is low for improved pasture grasses, for example, King Ranch bluestem. Weed control and proper grazing are needed.

This soil has medium potential for native range plants. Short grasses are the main native vegetation. Potential is medium for wildlife habitat.

Potential is low for most urban and recreation uses. Very slow permeability, clayey texture, flooding, shrinking and swelling properties, low strength, and corrosivity to uncoated steel are limitations.

This soil is in capability subclass IIIw and Draw range site.

32—Mangum clay, frequently flooded. This deep, nearly level soil is in oxbows on the flood plains of larger streams. Areas receive runoff from adjacent soils as well as overflow from the stream channels. Water stands on the surface for 1 to 4 months each year. Slopes are less than 0.5 percent. Areas are 20 to 150 acres.

Typically, this soil is calcareous, moderately alkaline, reddish brown clay to a depth of 60 inches.

This soil is moderately well drained. Surface runoff is very slow. Permeability is very slow, and available water capacity is high. The hazard of erosion is slight. The shrink-swell potential is high.

Included with this soil in mapping are spots of Mangum silty clay loam. They make up as much as 10 percent of a mapped area.

Most areas of this Mangum soil are used as rangeland. The soil is not suitable for cultivated crops and pastureland because of flooding and standing water.

This soil has low potential for native range plants. Short grasses and annuals are the main native vegetation. The potential is medium for wildlife habitat.

Potential is low for urban and recreation uses. The hazard of flooding, shrinking and swelling properties, clayey texture, very slow permeability, and corrosivity to uncoated steel are limitations.

This soil is in capability subclass Vw and Clayey Bottomland range site.

33—Minco very fine sandy loam, 0 to 1 percent slopes. This deep, nearly level soil is on uplands.

Typically, this soil is reddish brown very fine sandy loam to a depth of about 65 inches and brown loam to a depth of 80 inches. The soil is slightly acid in the upper part and grades to moderately alkaline in the lower part.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is high. The hazards of soil blowing and water erosion are low. The root zone is deep and is easily penetrated by roots. The shrink-swell potential is low.

Included with this soil in mapping are small, lower lying areas of Teller loam, which have plane slopes. Also included are small areas of gently sloping Minco soils. The included soils make up as much as 10 percent of a mapped area.

This Minco soil is used mainly for cultivated crops. A few areas are used for range. Wheat, grain sorghum, and cotton are the main crops.

This soil has high potential for cultivated crops. The use of crop residue and timely and limited tillage help to control soil blowing and water erosion and conserve soil moisture. Timely application of fertilizer and crop rotation help to maintain productivity.

The potential is high for improved pasture grasses, such as bermudagrass and kleingrass. Weed control, controlled grazing, and fertilizer increase the quantity and improve the quality of forage.

This soil has high potential for native range plants and for wildlife habitat. Mid and tall grasses are the main native vegetation.

Potential is high for most urban and recreation uses. Low strength is a limitation for local roads and streets.

This soil is in capability class I and Loamy Prairie range site.

34—Minco very fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands. Slopes are slightly convex and average about 2 percent. Areas average about 200 acres.

Typically, this soil is reddish brown very fine sandy loam to a depth of about 50 inches and calcareous, yellowish red very fine sandy loam to a depth of 80 inches. The soil is medium acid in the upper part and grades to moderately alkaline in the lower part.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is high. The hazards of water erosion and soil blowing are slight. The shrink-swell potential is low.

Included with this soil in mapping are small areas of Teller loam that make up as much as 10 percent of a mapped area.

Most areas of this Minco soil are cultivated.

This soil has high potential for wheat, cotton, and grain sorghum. Leaving crop residue on the surface, timely and limited tillage, rotation of crops, terracing, contour farming, and timely application of fertilizer help to control soil blowing and water erosion, conserve soil moisture, and maintain productivity.

The potential is high for improved pasture grasses, such as bermudagrass and kleingrass. Weed control, controlled grazing, and fertilizer improve the quality and increase the quantity of forage.

This soil has high potential for native range plants and for wildlife habitat.

Potential is high for urban and recreation uses. Low strength is a limitation for local roads and streets.

This soil is in capability subclass IIe and Loamy Prairie range site.

35—Minco very fine sandy loam, 3 to 5 percent slopes. This deep, gently sloping soil is on uplands. Slopes are convex. Areas range from 15 to 100 acres.

Typically, this soil is reddish brown very fine sandy loam to a depth of about 50 inches. The underlying material is calcareous, yellowish red very fine sandy loam to a depth of 80 inches. The soil is neutral in the upper part and grades to moderately alkaline in the lower part.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is high. The hazard of soil blowing is slight, and the hazard of water erosion is moderate. The shrink-swell potential is low.

Included with this soil in mapping are small areas of Minco very fine sandy loam, 1 to 3 percent slopes, and Minco very fine sandy loam, 5 to 8 percent slopes. The included soils make up as much as 15 percent of each mapped area.

This Minco soil has medium potential for cultivated crops. Leaving crop residue on the surface, timely and limited tillage, rotation of crops, terracing, contour farming, and timely application of fertilizer help to control soil blowing and water erosion, conserve soil moisture, and maintain productivity.

The potential is high for improved pasture grasses, such as bermudagrass and kleingrass. Weed control, controlled grazing, and fertilizer improve the quality and increase the quantity of forage.

This soil has high potential for native range plants and for wildlife habitat.

Potential is medium to high for most urban and recreation uses. Slope is a limitation for some uses. Low strength is a limitation for local roads and streets.

This soil is in capability subclass IIIe and Loamy Prairie range site.

36—Minco very fine sandy loam, 5 to 8 percent slopes. This deep, sloping soil is on uplands. Slopes are convex. Areas are long and narrow.

Typically, this soil is reddish brown very fine sandy loam to a depth of about 50 inches and yellowish red very fine sandy loam to a depth of 80 inches. This soil is slightly acid in the upper part and grades to moderately alkaline in the lower part.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is

high. The hazard of soil blowing is slight, and the hazard of water erosion is severe. The shrink-swell potential is low.

Included with this soil in mapping are areas of Enterprise very fine sandy loam that make up as much as 15 percent of some mapped areas.

This Minco soil has medium potential for closely spaced crops such as wheat. The potential is low for row crops because of the hazard of water erosion. Use of crop residue, timely and limited tillage, terraces and diversions, planting closely spaced crops, rotation of crops, and fertilizer help to control erosion, conserve moisture, and maintain productivity.

The potential is medium for improved pasture grasses, such as bermudagrass and kleingrass. Weed control, controlled grazing, and timely application of fertilizer improve the quality and increase the quantity of forage.

This soil has high potential for native range plants and for wildlife habitat.

Potential is medium to high for most urban and recreation uses. Slope is a limitation for some uses. Low strength is a limitation for local roads and streets.

This soil is in capability subclass IVe and Loamy Prairie range site.

37—Motley loam, 0 to 1 percent slopes. This deep, nearly level soil is on uplands. Slopes are plane. Areas are 50 to 200 acres.

Typically, the surface layer is neutral, brown loam about 9 inches thick. The subsoil extends to a depth of 80 inches. It is neutral, reddish brown sandy clay loam to a depth of 35 inches; neutral, yellowish red sandy clay loam to a depth of 70 inches; and moderately alkaline, yellowish red loam to a depth of 80 inches.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is high. The hazards of soil blowing and water erosion are slight. The root zone is deep and is easily penetrated by roots. The shrink-swell potential is low.

Included with this soil in mapping are small areas of Minco very fine sandy loam and Teller loam which make up as much as 15 percent of some mapped areas.

This Motley soil is used mainly for cultivated crops. A few areas are used for range.

This soil has high potential for cultivated crops. Leaving crop residue on or near the soil surface, timely and limited tillage, and rotation of crops help to reduce the hazards of soil blowing and water erosion, conserve soil moisture, and maintain productivity. In dry years, emergency tillage is sometimes needed to roughen the surface and to reduce damage from soil blowing. Timely application of fertilizer increases yield.

The potential is high for improved pasture grasses, such as bermudagrass and kleingrass. Weed control, controlled grazing, and fertilizer increase the quantity and improve the quality of forage.

This soil has high potential for native range plants and for wildlife habitat. Mid and tall grasses are the main native vegetation.

Potential is high for most urban and recreation uses. Low strength is a limitation for local roads and streets.

This soil is in capability subclass IIc and Loamy Prairie range site.

38—Motley loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands. Slopes are convex and average about 1.8 percent. Areas are 75 to 400 acres.

Typically, the surface layer is neutral, brown loam about 7 inches thick. The subsoil extends to a depth of 80 inches. It is neutral, reddish brown sandy clay loam to a depth of 33 inches; mildly alkaline, red sandy clay loam to a depth of 63 inches; and moderately alkaline, red loam to a depth of 80 inches.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is high. The hazard of soil blowing is slight, and the hazard of water erosion is moderate. The root zone is deep and is easily penetrated by roots. The shrink-swell potential is low.

Included with this soil in mapping are small areas of Teller loam and Minco very fine sandy loam. The included soils make up as much as 10 percent of some mapped areas.

Most areas of this Motley soil are used for cultivated crops. A few areas are used for improved pasture and range.

This soil has high potential for cultivated crops. Crop residue needs to be kept on the surface to control soil blowing and water erosion, conserve soil moisture, and maintain productivity. Terracing and contour farming also help to control water erosion and conserve moisture. Emergency tillage is needed to roughen the surface if crop growth or residue do not produce adequate cover to prevent damage from soil blowing.

The potential is high for improved pasture grasses. Weed control, controlled grazing, and timely application of fertilizer improve the quality and increase the quantity of forage.

This soil has high potential for native range plants and for wildlife habitat.

Potential is high for most urban and recreation uses. Slope can be a limitation for some uses. Low strength is a limitation for local roads and streets.

This soil is in capability subclass IIe and Loamy Prairie range site.

39—Motley loam, 3 to 5 percent slopes. This deep, gently sloping soil is on uplands. Slopes are convex.

Typically, the surface layer is neutral, brown loam about 6 inches thick. The subsoil extends to a depth of 80 inches. It is neutral, reddish brown sandy clay loam to a depth of 31 inches; mildly alkaline, yellowish red sandy clay loam to a depth of 64 inches; and moderately alkaline, yellowish red loam to a depth of 80 inches.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is high. The hazard of soil blowing is slight, and the hazard

of water erosion is moderate. The shrink-swell potential is low.

Included with this soil in mapping are areas of Minco very fine sandy loam. Also included are areas of sloping Motley loam that average about 10 percent of each mapped area. The included soils make up as much as 15 percent of each mapped area.

Most areas of this soil are used for range. A few areas are used for cultivated crops and improved pasture.

This soil has medium potential for cultivated crops. Surface runoff and the hazard of water erosion are limitations. Leaving crop residue on the surface, timely and limited tillage, rotation of crops, terracing, contour farming, and timely application of fertilizer reduce damage from soil blowing and water erosion, conserve soil moisture, and maintain productivity. In dry years, emergency tillage is sometimes needed to reduce soil blowing if crop growth and residue do not produce adequate cover.

The potential is medium for improved pasture grasses, such as bermudagrass and kleingrass. Weed control, controlled grazing, and fertilizer increase the quantity and improve the quality of forage.

This soil has high potential for native range plants and for wildlife habitat.

Potential is medium for most urban and recreation uses. Slope is a limitation for some uses. Low strength is a limitation for local roads and streets.

This soil is in capability subclass IIIe and Loamy Prairie range site.

40—Nebgen-Grandfield-Callahan association, sloping. These very shallow to deep soils are on uplands. Slopes range from 5 to 8 percent. Areas are long and narrow and range from 20 to several hundred acres.

Nebgen soils make up about 30 percent of this association; Grandfield soils, about 30 percent; Callahan soils, about 20 percent; and other soils, 20 percent. The very shallow and shallow Nebgen soils are on the upper parts of the association, the moderately deep Callahan soils are on the mid slopes, and the deep Grandfield soils are on the lower slopes. The composition of this association is more varied than that of other map units in Clay County. However, mapping has been controlled well enough for the anticipated use of the area.

Typically, the Nebgen soil (fig. 8) has a surface layer of slightly acid, brown, stony fine sandy loam about 6 inches thick. Strongly cemented, reddish yellow sandstone is at a depth of 6 inches.

The Nebgen soil is well drained. Surface runoff is rapid. Permeability is moderately rapid, and available water capacity is very low. The hazard of water erosion is severe, and the hazard of soil blowing is moderate. The shrink-swell potential is low.

Typically, the Grandfield soil has a surface layer of slightly acid, brown fine sandy loam about 9 inches thick. The subsoil extends to a depth of 80 inches. It is neutral, reddish brown sandy clay loam to a depth of 50 inches

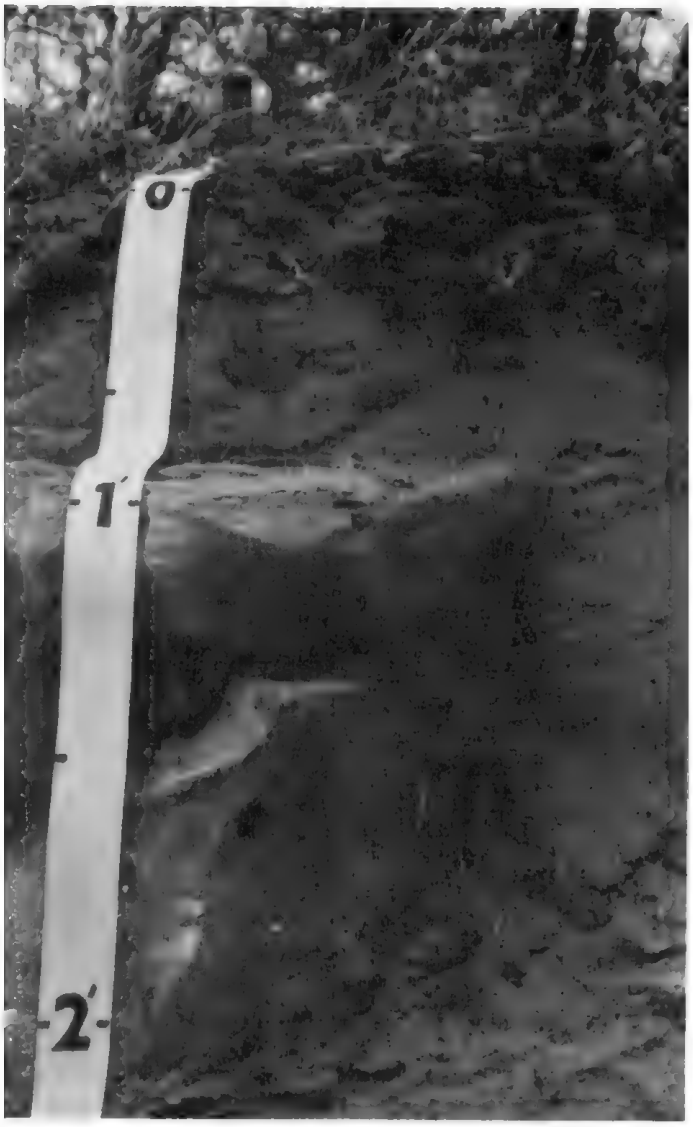


Figure 8.—Profile of Nebgen stony fine sandy loam. Weakly cemented sandstone is at a depth of about 8 inches.

and moderately alkaline, yellowish red loam to a depth of 80 inches.

The Grandfield soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is medium. The hazards of water erosion and soil blowing are moderate. The shrink-swell potential is low.

Typically, the Callahan soil (fig. 9) has a surface layer of neutral, brown loam about 10 inches thick. The subsoil extends to a depth of 35 inches. It is reddish brown clay that is mildly alkaline in the upper part and moderately alkaline in the lower part. The underlying material is red clayey shale.

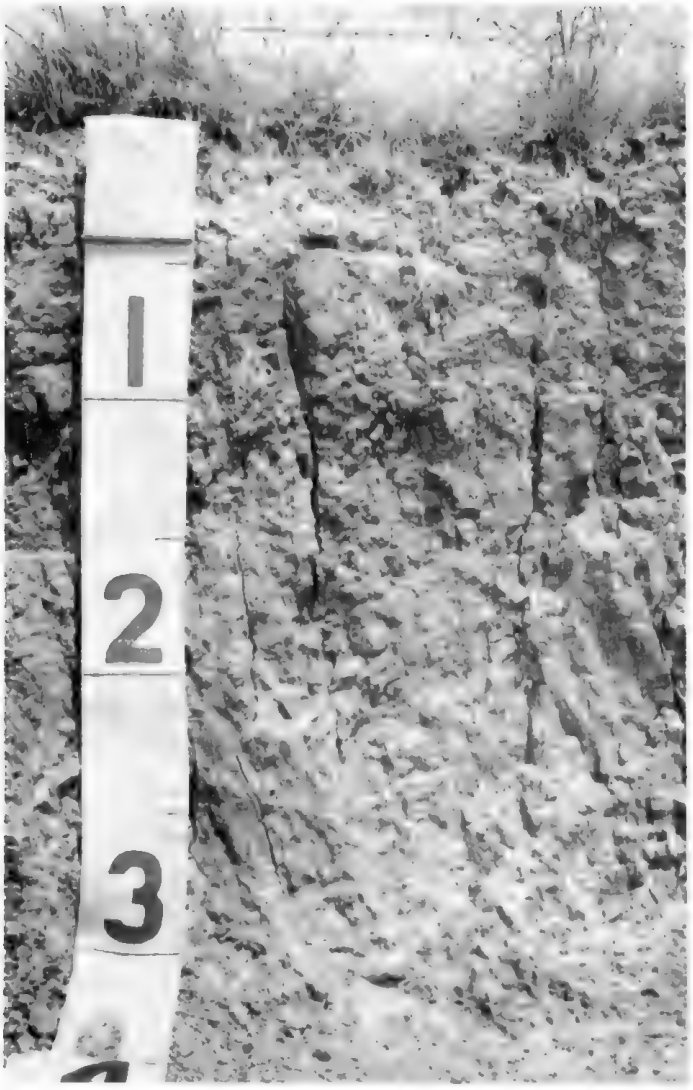


Figure 9.—Profile of Callahan loam. Clayey shale is at a depth of about 34 inches.

The Callahan soil is well drained. Surface runoff is medium. Permeability is very slow, and available water capacity is low. The hazard of water erosion is severe, and the hazard of soil blowing is slight. The shrink-swell potential is moderate.

Included with these soils in mapping are small areas of Darnell soils and Vernon soils and small areas of sandstone outcrop. Also included are small areas of soils that are gently sloping and strongly sloping. The included soils make up about 20 percent of the association.

Most areas of this Nebgen-Grandfield-Callahan association are used for rangeland. The soils are not suited to cultivated crops or to pasture because of slope, rooting depth, and stoniness. In addition, the hazard of water erosion is severe in much of this association.

These soils have medium potential for native range plants. A mixture of tall, mid, and short grasses makes up the native vegetation. Proper stocking, controlled grazing, and brush management are needed. The potential is high for wildlife habitat.

Potential is low for most urban and recreation uses. Slope, depth to rock, shrinking and swelling properties, stoniness, and low strength are the main limitations.

Nebgen soils are in capability subclass VIIs and Sandstone Hills range site; Grandfield soils are in capability subclass IVe and Sandy Loam range site; Callahan soils are in capability subclass VIs and Claypan Prairie range site.

41—Nebgen-Owens complex, 3 to 25 percent slopes. These very shallow and shallow, gently sloping to steep soils are on sandstone "capped" escarpments on uplands (fig. 10). Areas range from 15 to 300 acres.

Nebgen soils make up about 45 percent of this complex; Owens soils, 30 percent; Darnell soils, 10 percent; and other soils and sandstone outcrop, about 15 percent. Nebgen soils are on the upper parts of the complex, and Owens soils are on lower lying, steeper parts. The composition of this complex is more varied than that of other map units in Clay County. However, mapping has been controlled well enough for the anticipated use of the area.

The Nebgen soil has about 15 percent of the surface covered with sandstone fragments more than 3 inches in diameter. Typically, the surface layer is slightly acid, brown fine sandy loam about 6 inches thick. It contains about 3 percent by volume sandstone fragments less than 3 inches in diameter. Grayish, weakly cemented sandstone is at a depth of 6 inches.

The Nebgen soil is well drained. Surface runoff is rapid. Permeability is moderately rapid, and available water capacity is very low. The hazard of water erosion is severe, and the hazard of soil blowing is slight. The shrink-swell potential is low.

The Owens soil has about 40 percent of the surface covered with sandstone rocks or boulders that are more than 12 inches in diameter. Typically, the surface layer is calcareous, reddish brown clay about 5 inches thick. The subsoil is calcareous, reddish brown clay to a depth of 14 inches. The underlying material is reddish, clayey shale.

The Owens soil is well drained. Surface runoff is rapid. Permeability is very slow, and available water capacity is very low. The hazard of water erosion is severe, and the hazard of soil blowing is slight. The shrink-swell potential is high.

Included with these soils in mapping are small areas of Grandfield soils on foot slopes below escarpments and small areas of Bluegrove soils and Stoneburg soils above escarpments. Also included are outcrops and ledges of sandstone. The included soils make up about 15 percent of the complex.

Figure 10.—Area of Nebgen-Owens complex, 3 to 25 percent slopes. Nebgen soils are on the upper slopes, and Owens soils are on the lower slopes. These soils are in Sandstone Hills range site.

This Nebgen-Owens complex is used mainly for rangeland. The soils are not suited to cultivated crops or improved pasture grasses. Rooting depth, slope, and stoniness are limitations.

These soils have medium potential for native range plants. Tall and mid grasses are the main native vegetation. Oak trees grow in some areas. Potential is low for wildlife habitat.

Potential is low for urban and recreation uses. Slope, depth to rock, very slow permeability, shrinking and swelling properties, and the stony surface layer are limitations.

This complex is in capability subclass VIIs. Nebgen soils are in Sandstone Hills range site, and Owens soils are in Rocky Hills range site.

42—Nipsum clay loam, 0 to 2 percent slopes. This deep, nearly level to gently sloping soil is on broad foot slopes below escarpments. Slopes average about one percent. Areas are 150 to 500 acres.

Typically, the surface layer is mildly alkaline, noncalcareous, brown clay loam about 6 inches thick. Below that layer, the soil is moderately alkaline, calcareous, reddish brown clay to a depth of 60 inches and moderately alkaline, calcareous, yellowish red clay to a depth of 80 inches.

This soil is well drained. Surface runoff is medium. Permeability is slow, and available water capacity is medium. The hazard of water erosion is slight to moderate, and the hazard of soil blowing is slight. The shrink-swell potential is moderate.

Included with this soil in mapping are small areas of Mangum soils that make up as much as 10 percent of some areas.

Most areas of this Nipsum soil are cultivated.

This soil has medium potential for cultivated crops. Diversion terraces help to protect areas from outside water. Terracing and contour farming help to control water erosion. Leaving crop residue on the surface helps to conserve soil moisture, improve tilth, and maintain productivity.

The potential is medium for improved pasture grasses, such as King Ranch bluestem and kleingrass. Controlled grazing, weed control, and fertilizer are needed.

This soil has medium potential for native range plants and for wildlife habitat. Short and mid grasses are the main native vegetation. Proper stocking, controlled grazing, and brush management are needed.

Potential is medium for most urban and recreation uses. Shrinking and swelling properties, the clayey texture, low strength, and slow permeability are the main limitations.

This soil is in capability subclass IIe and Draw range site.

43—Port clay loam, occasionally flooded. This deep, nearly level soil is on flood plains. Slopes average about 0.2 percent. Most areas have meandering drainageways 3 to 5 feet deep that cut across the flood plain. Most areas of this soil are flooded about twice in 15 years; however, about 20 percent of the map unit is flooded an average of twice in 5 years.

Typically, the surface layer is neutral, brown clay loam about 17 inches thick. The subsoil is neutral, dark grayish brown silty clay loam to a depth of 40 inches. Below that, the subsoil and underlying material are mildly alkaline, reddish brown silty clay loam.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is high. The hazards of soil blowing and water erosion are slight. The shrink-swell potential is moderate.

Included with this soil in mapping are small areas of a soil that is similar to this Port soil but is loam throughout the profile. This soil, which is near drainageways, makes up as much as 10 percent of some mapped areas.

This Port soil is used mainly as rangeland. A few areas are used for cultivated crops.

This soil has high potential for cultivated crops. Leaving crop residue on the surface, timely and limited tillage, and rotation of crops help to control erosion, conserve soil moisture, and maintain productivity. Timely application of fertilizer increases yield.

The potential is high for improved pasture grasses, such as bermudagrass and kleingrass. Weed control, controlled grazing, and fertilizer increase the quantity and improve the quality of forage.

This soil has high potential for native range plants and for wildlife habitat.

Potential is low for most urban and recreation uses. Flooding is the main limitation.

This soil is in capability subclass IIw and Loamy Bottomland range site.

44—Port soils, frequently flooded. These deep, nearly level soils are on flood plains of smaller creeks and along drainageways. Slopes average about 0.5 percent. Areas are long and narrow. Most areas have meandering drainageways that have cut into the flood plain to a depth of 3 to 7 feet. These soils are flooded about 3 times in 5 years. However, about 20 percent of the wider areas are flooded less often. The surface layer of these soils is silt loam or clay loam. These soil areas are not uniform in pattern; however, the use and management are similar.

Typically, the surface layer is mildly alkaline, brown silt loam about 25 inches thick. The subsoil extends to a depth of 50 inches. It is mildly alkaline, brown silty clay loam to a depth of 44 inches and moderately alkaline, reddish brown silty clay loam below that layer. The substratum is moderately alkaline, yellowish red loam.

These soils are well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is high. The hazards of soil blowing and water erosion are slight. The shrink-swell potential is moderate.

Included with these soils in mapping are small areas of soils that are similar to the Port soils but have a sandier surface layer. These soils make up about 10 percent of the mapped areas.

Most areas of these Port soils are used for range. Mid and tall grasses and elm, hackberry, post oak, and pecan trees are the main vegetation. The trees grow along stream channels. The soils are not suited to cultivated crops because of the hazard of flooding.

These soils have high potential for improved pasture grasses, such as bermudagrass and kleingrass. Weed control, controlled grazing, and fertilizer are needed.

The potential is high for native range plants and for wildlife habitat.

Potential is low for most urban and recreation uses. Flooding is the main limitation.

These soils are in capability subclass Vw and Loamy Bottomland range site.

45—Renfrow-Kirkland-Anocon association, nearly level. These deep soils are on uplands. Slopes average 2 percent and range from 0 to 3 percent. Areas are irregularly shaped and range from 100 to several thousand acres.

Renfrow soils make up about 30 percent of this association; Kirkland soils, 30 percent; Anocon soils, 30 percent; and other soils, 10 percent. Kirkland soils are on the lower, less sloping parts of the association, and Renfrow and Anocon soils are on the higher lying parts. These soils could be mapped separately; however, because use and management are similar, separation is not justified.

Typically, the Renfrow soil has a surface layer of slightly acid, brown loam about 9 inches thick. The subsoil extends to a depth of 80 inches. It is slightly acid, reddish brown clay loam to a depth of 15 inches; neutral, reddish brown clay to a depth of 30 inches; and

moderately alkaline, yellowish red clay to a depth of 80 inches.

Typically, the Kirkland soil has a surface layer about 12 inches thick. It is slightly acid, brown silt loam in the upper 9 inches and neutral, dark grayish brown silt loam in the lower 3 inches. The subsoil extends to a depth of 80 inches. It is very firm, dark grayish brown clay in the upper part that grades to brown in the middle part and to yellowish red in the lower part. The subsoil is neutral in the upper part and grades to moderately alkaline in the lower part.

Typically, the Anocon soil has a surface layer of slightly acid, grayish brown loam about 13 inches thick. The subsoil extends to a depth of 80 inches. It is slightly acid, reddish brown clay loam to a depth of 19 inches; neutral, reddish brown clay to a depth of 30 inches; mildly alkaline, yellowish brown clay to a depth of 54 inches; and moderately alkaline, yellowish red clay loam to a depth of 80 inches.

These soils are well drained. Surface runoff is slow to medium. Permeability of the Kirkland soil and Renfrow soil is very slow, and permeability of the Anocon soil is moderately slow. Available water capacity is high. The hazard of water erosion is slight to moderate. The shrink-swell potential of the Renfrow soil and the Kirkland soil is high, and shrink-swell potential of the Anocon soil is moderate.

Included with these soils in mapping are small areas of Stoneburg and Bluegrove soils on higher, convex ridges, Waurika soils on lower lying areas that have concave surfaces, and a few spots of Kamay soils and Deandale soils. The included soils make up as much as 10 percent of some mapped areas.

Most areas of this Renfrow-Kirkland-Anocon association are used for range. A few areas are used for cultivated crops. Wheat is the main crop.

These soils have high potential for wheat. The potential is medium for warm-season crops, such as cotton and grain sorghum. Droughtiness in summer reduces yields in most years. Leaving crop residue on the surface, timely and limited tillage, rotation of crops, contour farming, and installing terraces and grassed waterways help to control soil blowing and water erosion and to conserve soil moisture. Use of residue also helps maintain productivity and tilth. Emergency tillage is needed occasionally to roughen the soil surface. Roughening reduces damage from wind erosion if crop growth and residue do not produce adequate cover. Timely application of fertilizer increases yield.

The potential is medium for improved pasture grasses, such as bermudagrass and kleingrass. Weed control, controlled grazing, and fertilizer increase the quantity and improve the quality of forage.

These soils have medium to high potential for native range plants. Short and mid grasses are the main native vegetation. Potential is medium for wildlife habitat.

Potential is low for most urban and recreation uses. Very slow permeability, shrinking and swelling properties, and clayey texture are limitations.

Anocon soils are in capability subclass IIe and Loamy Prairie range site; Renfrow soils and Kirkland soils are in capability subclass IIs and Claypan Prairie range site.

46—Renfrow-Waurika complex, 0 to 2 percent slopes. These deep, nearly level to gently sloping soils are on uplands mainly along small drainageways and adjacent to depressional areas. Slopes are smooth and somewhat concave. Areas are irregular in shape and range from 25 to 500 acres.

Renfrow soils make up about 60 percent of this complex; Waurika soils, about 30 percent; and other soils, about 10 percent. These soils are intermingled on similar kinds of landforms. Because they are so intricately mixed, separation is not practical at the scale used in mapping.

Typically, the Renfrow soil has a surface layer of friable, slightly acid, brown loam about 9 inches thick. The subsoil extends to a depth of 65 inches. It is firm, slightly acid, reddish brown clay loam to a depth of 13 inches; firm, mildly alkaline, reddish brown clay to a depth of 30 inches; very firm, moderately alkaline and calcareous, reddish brown clay to a depth of 50 inches; and very firm, moderately alkaline and calcareous, red clay to a depth of 65 inches. The underlying material is red shaly clay.

Renfrow soil is well drained. Surface runoff is slow. Permeability is very slow, and available water capacity is high. The hazards of water erosion and soil blowing are slight. The shrink-swell potential is high.

Typically, the Waurika soil (fig. 11) has a surface layer of friable, slightly acid, grayish brown silt loam about 11 inches thick. The subsurface layer is slightly acid, light brownish gray silt loam about 3 inches thick. The subsoil extends to a depth of 65 inches. It is very firm, neutral, dark grayish brown clay to a depth of 39 inches and very firm, moderately alkaline, calcareous, brown clay to a depth of 65 inches. The substratum is firm, calcareous, light brownish gray clay.

Waurika soil is somewhat poorly drained. Surface runoff is slow. Permeability is very slow, and available water capacity is high. The hazards of water erosion and soil blowing are slight. The shrink-swell potential is high in the upper part of the subsoil and moderate in the lower part of the subsoil and in the substratum.

Included with these soils in mapping are a few small areas of Kirkland soils. They make up as much as 10 percent of the mapped areas.

The soils of this Renfrow-Waurika complex can be cultivated, but they are used mainly as rangeland.

These soils have medium potential for native range plants and for wildlife habitat. A mixture of short and mid grasses are the main native vegetation. Proper stocking, controlled grazing, and brush management are needed.

The potential is high for wheat. Leaving crop residue on the surface helps to conserve soil moisture.

These soils have medium potential for improved pasture grasses, such as King Ranch bluestem, coastal bermudagrass, kleingrass, and weeping lovegrass.

Figure 11.—Profile of Waurika silt loam.

Controlled grazing, weed control, and fertilizer are needed.

Potential is low for most urban and recreation uses. Shrinking and swelling properties, very slow permeability, and wetness are the main limitations.

This complex is in capability subclass IIs and Claypan Prairie range site.

47—Ships clay, occasionally flooded. This deep, nearly level soil is on bottom lands. Slopes are smooth and average about 0.2 percent. This soil is flooded briefly about once in 10 years. Areas are several thousand acres.

Typically, this soil is reddish brown clay to a depth of about 50 inches and red clay between a depth of 50 and 60 inches. It is noncalcareous in the upper 30 inches and calcareous below. Reaction is moderately alkaline throughout the profile.

This soil is moderately well drained. Surface runoff is slow. Permeability is very slow, and available water capacity is high. The hazard of water erosion is slight. The shrink-swell potential is very high.

Included with this soil in mapping are small areas of Mangum soils and Weswood soils, which make up as much as 15 percent of the mapped areas.

This Ships clay is mainly used as rangeland.

This soil has medium potential for native range plants. Short grasses are the main native vegetation. Proper stocking, controlled grazing, and brush management are needed. Potential is medium for wildlife habitat.

This soil has low potential for cultivated crops. Leaving crop residue on the surface helps to conserve soil moisture and maintain tilth and productivity.

The potential is low for improved pasture grasses. However, King Ranch bluestem and kleingrass are suited to this soil. Controlled grazing, weed control, and timely application of fertilizer are needed.

Potential is low for most urban and recreation uses. The hazard of flooding, the clayey surface layer, very slow permeability, wetness, and shrinking and swelling properties are the main limitations.

This soil is in capability subclass IIw and Clayey Bottomland range site.

48—Stephenville loamy fine sand, 0 to 3 percent slopes. This nearly level to gently sloping, moderately deep soil is on uplands. Areas range from 50 to 500 acres.

Typically, the surface layer is slightly acid, brown loamy fine sand about 5 inches thick. The subsurface layer is slightly acid, light yellowish brown loamy fine sand about 10 inches thick. The subsoil extends to a depth of 33 inches. It is firm, medium acid sandy clay loam that is yellowish red in the upper part and reddish yellow in the lower part. The underlying material is weakly cemented, slightly acid sandstone.

This soil is well drained. Surface runoff is slow to medium. Permeability is moderate, and available water capacity is low. The hazard of soil blowing is severe, and the hazard of water erosion is moderate. The shrink-swell potential is low.

Included with this soil in mapping are small areas of Bonti fine sandy loam and areas of sandstone outcrop. The included soils make up about 15 percent of some mapped areas.

This Stephenville soil is used mainly as rangeland. It has limited suitability for cultivated crops.

This soil has medium potential for native range plants. A mixture of tall and mid grasses, forbs, and oak trees are the main native vegetation. Proper stocking, controlled grazing, and brush management are needed. The potential is high for upland wildlife habitat.

The potential is medium for most cultivated crops. Leaving crop residue on the surface helps to conserve soil moisture, control soil blowing, and maintain tilth. Terracing and contour farming are needed in some areas

to control water erosion. Timely application of fertilizer is needed to maintain soil fertility and yield.

This soil has high potential for improved pasture. Coastal bermudagrass, weeping lovegrass, and kleingrass are well suited to this soil. Weed control, controlled grazing, and fertilizer are needed to maintain maximum production of high quality forage.

Potential is medium for most urban and recreation uses. Low strength, depth to bedrock, and the sandy surface layer are the main limitations.

This soil is in capability subclass IIIe and Loamy Sand range site.

49—Stoneburg-Bluegrove association, gently sloping. These moderately deep soils are on ridges. Slopes are smooth and convex. They range from 1 to 5 percent but average about 2.5 percent. Areas range from 30 to several hundred acres.

Stoneburg soils make up about 60 percent of this association; Bluegrove soils, about 20 percent; and other soils, about 20 percent. The Stoneburg and Bluegrove soils are intermingled on similar kinds of landforms. The mapped areas of this association are much larger and the composition is more varied than other map units in Clay County. However, mapping has been controlled well enough for the anticipated use of the areas.

Typically, the Stoneburg soil (fig. 12) has a surface layer of slightly acid, brown loam about 12 inches thick. The subsoil extends to a depth of 38 inches. It is slightly acid, reddish brown sandy clay loam to a depth of 17 inches; firm, neutral, reddish brown clay loam to a depth of 28 inches; and firm, mildly alkaline, reddish yellow clay loam to a depth of 38 inches. The underlying material is weakly cemented sandstone.

The Stoneburg soil is well drained. Surface runoff is medium. Permeability is moderately slow, and available water capacity is low. The hazard of soil blowing is slight, and the hazard of water erosion is moderate. The shrink-swell potential is moderate.

Typically, the Bluegrove soil has a surface layer of slightly acid, brown loam about 6 inches thick. The subsoil is slightly acid, reddish brown clay loam to a depth of 30 inches. The underlying material is weakly cemented sandstone interbedded with clay.

The Bluegrove soil is well drained. Runoff is medium. Permeability is moderately slow, and available water capacity is low. The hazard of water erosion is moderate, and the hazard of soil blowing is slight. The shrink-swell potential is moderate.

Included with these soils in mapping are areas of Anocon, Kirkland, and Renfrow soils. They are on lower lying slopes and in nearly level areas between ridges.

The soils of this Stoneburg-Bluegrove association have medium potential for wheat and grain sorghum. Terracing and contour farming help to control water erosion. Use of crop residue helps to conserve soil moisture and maintain tilth and productivity.

Figure 12.—Profile of Stoneburg fine sandy loam. Fractured sandstone is at a depth of about 36 inches.

The potential is high for improved pasture grasses. Coastal bermudagrass, kleingrass, and weeping lovegrass are well suited to these soils. Weed control, controlled grazing, and timely application of fertilizer are needed to maintain maximum production of high quality forage.

These soils have high potential for native range plants and for wildlife habitat.

Potential is medium for most urban uses. Depth to bedrock, shrinking and swelling properties, and moderately slow permeability are the main limitations. The potential is high for recreation uses.

This association is in capability subclass IIIe. Stoneburg soils are in Loamy Prairie range site, and Bluegrove soils are in Tight Sandy Loam range site.

50—Teller loam, 0 to 1 percent slopes. This deep, nearly level soil is on uplands. Areas average about 500 acres.

Typically, the surface layer is slightly acid, brown loam about 8 inches thick. The subsoil extends to a depth of 60 inches. It is slightly acid, dark brown sandy clay loam to a depth of 16 inches; neutral, brown sandy clay loam to a depth of 48 inches; and moderately alkaline, yellowish brown sandy clay loam to a depth of 60 inches. The substratum is moderately alkaline, brownish yellow sandy clay loam.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is high. The hazards of soil blowing and water erosion are slight. The shrink-swell potential is low.

Included with this soil in mapping are small areas of Minco, Motley, and Altus soils. Also included are small areas of a soil that is similar to the Teller soil but has a dark surface layer more than 20 inches thick. The included soils make up as much as 10 percent of the mapped areas.

This Teller soil has high potential for cultivated crops. Leaving crop residue on the surface, timely and limited tillage, and rotation of crops help to control soil blowing and water erosion and to conserve soil moisture. Use of residue also helps to maintain productivity and tilth. Timely application of fertilizer increases yield.

The potential is high for improved pasture grasses, such as bermudagrass and kleingrass. Weed control, control of grazing, and fertilizer are needed to increase the quantity and improve the quality of forage.

This soil has high potential for native range plants and for wildlife habitat. Mid and tall grasses are the main native vegetation.

Potential is high for most urban and recreation uses.

This soil is in capability class I and Loamy Prairie range site.

51—Tivoli fine sand. This deep, sloping soil is on uplands. Surfaces are convex. Slopes range from 5 to 8 percent. Areas are long and narrow and average about 20 to 100 acres.

Typically, the surface layer is loose, mildly alkaline, brown fine sand about 9 inches thick. The substratum is loose, moderately alkaline, reddish yellow fine sand to a depth of 60 inches.

This soil is excessively drained. Surface runoff is very slow. Permeability is rapid, and available water capacity is very low. The hazard of water erosion is slight, and the hazard of soil blowing is severe. The shrink-swell potential is low.

Included with this soil in mapping are small areas of Lincoln soils and Yomont soils in lower lying parts of the map unit. The included soils make up as much as 15 percent of some mapped areas.

Most areas of this Tivoli soil are used as rangeland. They are not suitable for cultivated crops or pasture. Very low available water capacity, the sandy texture, and the hazard of soil blowing are limitations.

This soil has low potential for native range plants and for wildlife habitat. Tall and mid grasses are the main native vegetation. Proper stocking, control of grazing, and brush management are needed.

Potential is low for most urban and recreation uses. The sandy texture, soil blowing, slope, and caving of cutbanks are the main limitations. This soil is a fair source of sand for construction purposes.

This soil is in capability subclass VIIe and Very Deep range site.

52—Treadway clay, 0 to 2 percent slopes. This deep, nearly level and gently sloping soil is on alluvial fans. Slopes average about 0.6 percent. This soil is occasionally flooded by runoff from higher lying soils. Areas are irregularly shaped and average about 118 acres.

Typically, this soil is firm, moderately alkaline, calcareous, reddish brown clay to a depth of 60 inches.

This soil is well drained. Surface runoff is very rapid. Permeability is slow, and available water capacity is low. The hazards of water erosion and soil blowing are moderate. The shrink-swell potential is high.

Included with this soil in mapping are areas of Mangum soil along narrow drainageways and small areas of Treadway clay loam and Treadway silty clay loam. The included soils make up as much as 10 percent of the mapped areas.

Most areas of this Treadway soil are used for range. A few areas are used for cultivated crops. This soil is not suited to cultivated crops or improved pasture grasses mainly because of droughtiness.

This soil has low potential for native range plants and for wildlife habitat. Short grasses are the main native vegetation.

Potential is low for most urban and recreation uses. The clayey texture, shrinking and swelling properties, low strength, corrosivity to uncoated steel, and slow permeability are limitations.

This soil is in capability subclass VIs and Clay Flat range site.

53—Vernon clay, 1 to 5 percent slopes. This moderately deep, gently sloping soil is on uplands. Slopes average about 2.5 percent. Areas range from 15 to 300 acres.

Typically, the surface layer is reddish brown clay about 17 inches thick. The subsoil is red clay to a depth of about 32 inches. The underlying material is red clayey shale. This soil is calcareous and moderately alkaline throughout the profile.

This soil is well drained. Surface runoff is rapid. Permeability is very slow, and available water capacity is low. The hazards of water erosion and soil blowing are moderate. The shrink-swell potential is high. This soil is droughty.

Included with this soil in mapping are small areas of Owens soils, areas of Kamay soils in lower lying parts of

the map unit, and small areas of Bluegrove soils on ridgetops. Narrow bands of sandstone outcrop are in a few places. The included soils make up as much as 15 percent of most mapped areas.

Most areas of this Vernon soil are used for range. A few areas are used for cultivated crops.

This soil has low potential for cultivated crops. Depth of the root zone, the hazard of water erosion, very slow permeability, droughtiness, and rapid surface runoff are limitations. Planting high residue crops and leaving the residue on the surface, rotation of crops, terracing, and contour farming help to reduce damage from water erosion.

The potential is low for improved pasture grasses.

This soil has low potential for native range plants and for wildlife habitat. Short grasses are the main native vegetation.

Potential is low for most urban and recreation uses. The clayey texture, very slow permeability, shrinking and swelling properties, low strength, and corrosivity to uncoated steel are limitations.

This soil is in capability subclass IVe and Shallow Clay range site.

54—Weswood silt loam, occasionally flooded. This deep, nearly level soil is on bottom lands. Surfaces are smooth. Most areas are on the flood plains of larger streams. These areas are flooded about once in 20 years. Slopes are predominantly less than 0.5 percent. Areas range from 75 to several hundred acres.

Typically, the surface layer is moderately alkaline, calcareous, reddish brown silt loam about 8 inches thick. The subsoil is moderately alkaline, calcareous, reddish brown silty clay loam to a depth of 36 inches. The substratum is moderately alkaline, calcareous, reddish brown silty clay loam that contains strata of very fine sandy loam, silt loam, and silty clay.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is high. The hazards of soil blowing and water erosion are slight. The shrink-swell potential is low.

Included with this soil in mapping are small areas of Weswood very fine sandy loam and Weswood silty clay loam. Also included are small, somewhat depressional spots of Mangum soils of less than 10 acres and higher, convex areas of Yomont soils near streambanks. The included soils make up as much as 10 percent of the mapped areas.

This Weswood soil is well suited to cultivated crops. Wheat is the main crop. About 80 percent of this map unit is cultivated. Other areas are used for range and pasture.

This soil has high potential for wheat, grain sorghum, and cotton. Leaving crop residue on the surface, timely and limited tillage, and rotation of crops help to control soil blowing and water erosion and to conserve soil moisture. Use of residue also helps to maintain productivity. Emergency tillage is occasionally needed to roughen the surface. Roughening helps to reduce damage from soil blowing if crop growth and residue do not produce adequate cover. Timely application of fertilizer increases yield.

The potential is high for improved pasture, such as coastal bermudagrass. Weed control, proper grazing, and fertilizer are needed to improve the quality and increase the quantity of forage.

This soil has high potential for range plants and for wildlife habitat. Mid and tall grasses are the main native vegetation. These grasses produce a large amount of forage.

Potential is low for most urban and recreation uses because of the hazard of flooding.

This soil is in capability subclass IIw and Loamy Bottomland range site.

55—Weswood Variant, occasionally flooded. These deep, nearly level soils are on bottom lands. The surface layer of these soils is silt loam, clay loam, or silty clay loam. The soils are flooded about once in every 15 to 20 years. Slopes are dominantly less than 0.5 percent. These soils are in one large area of about 1,500 acres (fig. 13).

Typically, the surface layer is about 10 inches thick. It is noncalcareous, dark grayish brown silt loam in the upper 3 inches and calcareous, reddish brown silty clay loam in the lower 7 inches. The subsoil is calcareous, reddish brown silty clay loam to a depth of 36 inches. The substratum is calcareous, yellowish red silt loam to a depth of 60 inches. The soil is saline and moderately alkaline throughout.

These soils are well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is high. The hazards of soil blowing and water erosion are slight. The water table is 6 to 10 feet below the surface. These soils range from slightly saline to strongly saline. The shrink-swell potential is low.

Included with these soils in mapping are small areas of Weswood soils that make up as much as 10 percent of an area.

These Weswood Variant soils are used entirely for rangeland.

These soils have low potential for cultivated crops and pasture. The high content of salt limits the growth of all plants. Only low quantities of forage can be produced.

These soils have low potential for range plants because of the high content of salt. Saltgrass, alkali sacaton, and switchgrass are the main native vegetation. The potential for wildlife habitat is high.

Potential is low for most urban and recreation uses. Wetness, salinity, and susceptibility to flooding are the main limitations.

These soils are in capability subclass IVw and Wet Bottomland range site.

56—Windthorst-Truce complex, 1 to 5 percent

Figure 13.—Area of Weswood Variant, occasionally flooded. This soil is in Wet Bottomland range site.

slopes. These deep, gently sloping soils are on uplands. Slopes are smooth and slightly convex, and average about 4 percent. Areas are irregular in shape and range from 20 to several hundred acres.

Windthorst soils make up about 50 percent of this complex; Truce soils, 30 percent; and other soils, 20 percent. In most areas, the Truce soils are at a higher elevation than the Windthorst soils. These soils are so intricately mixed that separation is not practical at the scale used in mapping.

Typically, the Windthorst soil (fig. 14) has a surface layer of neutral, brown fine sandy loam about 6 inches thick. The subsurface layer is neutral, brown fine sandy loam about 3 inches thick. The subsoil extends to a depth of 68 inches. To a depth of 33 inches, it is slightly acid, reddish brown sandy clay that has reddish and brownish mottles in the lower part. Between depths of 33 and 68 inches, it is sandy clay loam that has brownish, yellowish, grayish, and reddish mottles. The substratum is neutral, mottled yellowish, grayish, and reddish sandy clay.

The Windthorst soil is moderately well drained. Surface runoff is medium. Permeability is moderately slow, and available water capacity is high. The hazards of water erosion and soil blowing are moderate. The shrink-swell potential is moderate.

Typically, the Truce soil has a surface layer of neutral, brown fine sandy loam about 6 inches thick. The subsoil extends to a depth of 49 inches. It is neutral, reddish brown clay to a depth of 17 inches; mildly alkaline, brown clay to a depth of 24 inches; and moderately alkaline, light yellowish brown clay to a depth of 39 inches. Between depths of 39 and 49 inches, it is moderately alkaline, light olive gray clay that has segregations of calcium carbonate. The underlying material is calcareous, light olive gray clayey shale.

The Truce soil is well drained. Surface runoff is rapid. Permeability is slow, and available water capacity is medium. The hazards of water erosion and soil blowing are moderate. The shrink-swell potential is moderate.

Included with these soils in mapping are areas of Duffau soils, Waurika soils, and Bluegrove fine sandy

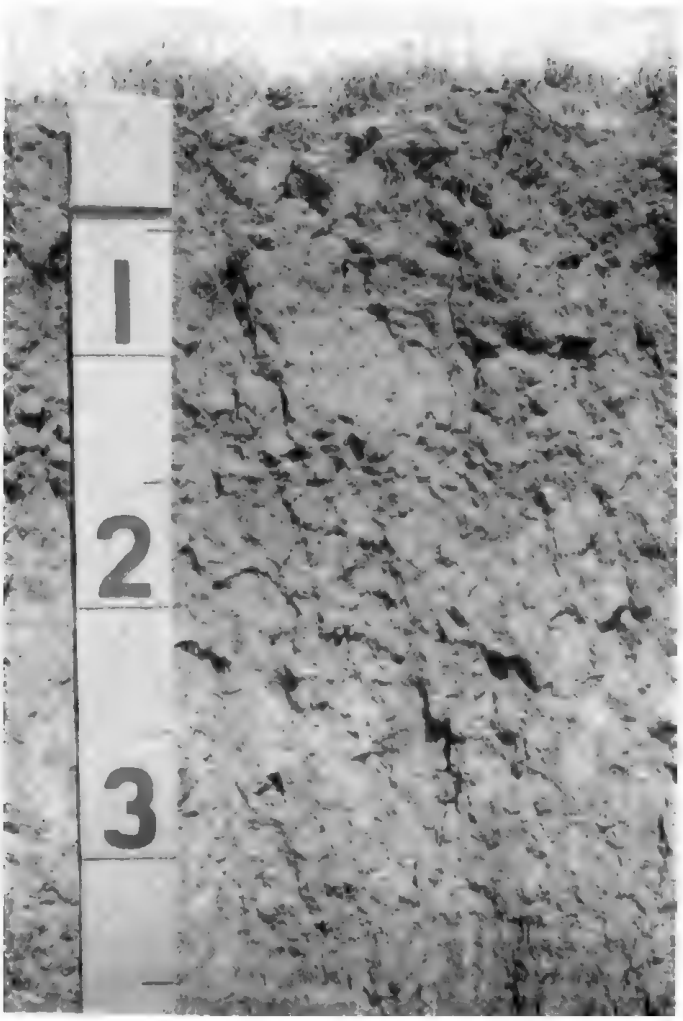


Figure 14.—Profile of Windthorst fine sandy loam.

loam. These soils make up as much as 20 percent of the mapped areas.

The soils of this Windthorst-Truce complex are suitable for cultivation, but they are used mainly as rangeland and pastureland.

These soils have high potential for native range plants and for wildlife habitat. A mixture of tall and mid grasses, forbs, and oak trees make up the native plant community. Proper stocking, control of grazing, and brush management are needed.

These soils have medium potential for cultivated crops. Keeping crop residue on the surface helps to conserve moisture and to control the hazard of soil blowing. Terraces and contour farming help to control water erosion.

The potential is high for improved pasture production. King Ranch bluestem, kleingrass, weeping lovegrass, and coastal bermudagrass are well suited to this soil. Control of grazing, weed control, and fertilizer are needed.

Potential is medium for most urban and recreation uses. Low strength, shrinking and swelling properties, moderately slow and slow permeability, and the clayey texture are the main limitations.

This complex is in capability subclass IIIe. Windthorst soils are in Sandy Loam range site, and Truce soils are in Tight Sandy Loam range site.

57—Winters loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands. Slopes are convex. Areas average about 160 acres and range from 50 to 200 acres.

Typically, the surface layer is slightly acid, reddish brown loam about 6 inches thick. The subsoil extends to a depth of 80 inches. It is neutral, reddish brown clay to a depth of 17 inches and neutral to moderately alkaline, red clay to a depth of 80 inches.

This soil is well drained. Surface runoff is medium. Permeability is moderately slow, and available water capacity is high. The hazard of water erosion is moderate, and the hazard of soil blowing is slight. The shrink-swell potential is moderate.

Included with this soil in mapping are areas of Deandale silt loam in the lower areas and small areas of nearly level Winters loam. The included soils make up as much as 10 percent of a mapped area.

A large part of this Winters soil is cultivated. The rest is in rangeland.

This soil has medium potential for cultivated crops. Leaving crop residue on the surface, timely and limited tillage, rotation of crops, terracing, and contour farming help to control soil blowing and water erosion, and to conserve soil moisture. Use of residue also helps to maintain productivity and tilth. Timely application of fertilizer increases yield.

The potential is medium for improved pasture grasses, such as bermudagrass and kleingrass. Weed control, controlled grazing, and fertilizer are needed to increase the quantity and improve the quality of forage.

This soil has medium potential for native range plants and for wildlife habitat.

Potential is medium for most urban and recreation uses. Moderately slow permeability, low strength, and shrinking and swelling properties are limitations.

This soil is in capability subclass IIe and Clay Loam range site.

58—Yomont very fine sandy loam, occasionally flooded. This deep, nearly level soil is on bottom lands. Areas average about 40 acres and range from 20 to 100 acres. About 20 percent of the total acreage has weakly undulating surfaces and slopes that range to 3 percent.

Typically, the surface layer is reddish brown very fine sandy loam about 7 inches thick. The underlying material is reddish brown very fine sandy loam that is stratified with thin layers of silt loam to loamy very fine sand. This soil is calcareous and moderately alkaline throughout the profile.

This soil is well drained. Surface runoff is slow. Permeability is moderately rapid, and available water capacity is high. The hazard of water erosion is slight, and the hazard of soil blowing is moderate. The shrink-swell potential is low. This soil is flooded about once in 20 years.

Included with this soil in mapping are small areas of Weswood silt loam that make up as much as 10 percent of some mapped areas.

About half of the area of Yomont soils is cultivated. The rest is used as range.

This soil has medium potential for cultivated crops. Leaving crop residue on the surface, timely and limited tillage, and rotation of crops help to control soil blowing and water erosion, conserve moisture, and increase productivity. Timely application of fertilizer increases yield.

The potential is high for improved pasture grasses, such as bermudagrass. Weed control, controlled grazing, and fertilizer increase the quantity and improve the quality of forage.

This soil has high potential for native range plants and for wildlife habitat.

Potential is low for most urban and recreation uses. The hazard of flooding is the main limitation.

This soil is in capability subclass IIw and Loamy Bottomland range site.

59—Yomont soils, frequently flooded. These deep, nearly level to gently undulating soils are on bottom lands. These soils are flooded about 2 or 3 times in 5 years. Areas range from 50 to 250 acres and average about 100 acres.

Yomont soils make up 70 percent of these areas; Mangum soils, 10 percent; and Weswood soils, 20 percent. The surface layer of these soils is silt loam, very fine sandy loam, or silty clay loam. These soil areas are not in a uniform pattern. However, use and management are similar.

Typically, the surface layer is reddish brown silt loam about 9 inches thick. The underlying material is yellowish red very fine sandy loam. The profile is calcareous and moderately alkaline throughout.

These soils are well drained. Surface runoff is slow. Permeability is moderately rapid, and available water capacity is high. The hazard of soil blowing is moderate, and the hazard of water erosion is slight. The shrink-swell potential is low.

Included with these soils in mapping are small areas of Lincoln soils that make up as much as 20 percent of some mapped areas.

These Yomont soils are not suited to cultivation because of the hazard of flooding.

The potential is high for improved pasture grasses, such as bermudagrass. Weed control, control of grazing, and timely application of fertilizer increase the quantity and improve the quality of forage.

These soils have high potential for native range plants and for wildlife habitat.

Potential is low for most urban and recreation uses. The hazard of flooding is the main limitation.

These soils are in capability subclass Vw and Loamy Bottomland range site.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Acreage in crops and pasture has gradually been increasing. More than 120,000 acres in the county was used for crops and pasture in 1967, according to the Conservation Needs Inventory (*3*). Of this total, 420 acres was used for improved pasture; 13,000 acres for row crops, mainly cotton; and 98,000 acres for close growing crops, mainly wheat. The rest was for conservation use.

The soils in Clay County have good potential for increased production of food. About 314,000 acres of potentially good cropland is currently used as rangeland. In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all cropland in the survey area. This soil survey can help facilitate the application of such technology.

In 1967 there was about 13,000 acres of built-up land in the survey area. This acreage has been slowly increasing each year, mainly because of suburban sprawl from the city of Wichita Falls in the adjacent county to the west of Clay County. The use of this soil survey to help make land use decisions that will influence the future role of farming in the survey area is discussed in "General soil map units."

Soil erosion is the major concern on about two-thirds of the cropland and pastureland in Clay County. If slope is more than 2 percent, erosion is a hazard. Some of the Kamay, Bluegrove, Stoneburg, Enterprise, and Motley soils have slopes of more than 2 percent.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, such as Kamay, Deandale, Kirkland, Renfrow, and Waurika soils. Second, soil erosion on farmland results in sedimentation of streams. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

In many sloping fields, tilling or preparing a good seedbed is difficult on clayey or hardpan spots because the original friable surface soil has been eroded away.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils. On livestock farms, which require pasture and hay, the legume and grass forage crops in the cropping system reduce erosion on sloping land, and also provide nitrogen and improve tilth for the following crop.

Minimizing tillage and leaving crop residue on the surface help to increase infiltration and reduce the hazards of runoff and erosion. These practices can be adapted to most soils in the survey area. No-tillage is effective in reducing erosion on sloping land and can be adapted to most soils in the survey area. It is more difficult to practice successfully, however, on the soils that have a clayey surface layer.

Terraces and diversions reduce the length of slope and reduce runoff and erosion. They are most effective on the loamy Enterprise, Grandfield, and Winters soils. The other soils are less suitable for terraces and diversions because they have a clayey subsoil which would be exposed in terrace channels, bedrock at a depth of less than 40 inches, or they are too sandy.

Contouring is a common erosion control practice in the survey area. It is best adapted to soils that have smooth, uniform slopes, including most areas of the sloping Kamay, Enterprise, Motley, Minco, Bluegrove, Stoneburg, Kirkland, and Renfrow soils.

Soil blowing is a hazard on the sandy Devol and Duffau soils. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining vegetative cover, surface mulch, or rough surfaces through proper tillage minimizes soil blowing on these soils. Windbreaks of adapted shrubs are effective in reducing soil blowing on the sandy soils.

Information for the design of erosion control practices for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils that have good tilth are granular and porous.

Wheat is the common close growing crop. However, rye, barley, and oats can be grown, and grass seed can be produced from kleingrass and King Ranch bluestem.

Specialty crops grown commercially in the survey area are primarily tree fruits. A small acreage in the northern part of the survey area is used for melons, sweet corn, and other vegetables and small fruits. Peaches are the most important tree fruit grown in the survey area.

Latest information and suggestions for growing specialty crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Farm use is competing with other land uses for large sections of the survey area. About 13,000 acres, or 2 percent of the survey area, was used as built-up land in 1967, according to the Conservation Needs Inventory (*3*). Much of this acreage was well suited to cropland.

Generally, the soils in the survey area that are well suited to crops are also well suited to urban development. The data about specific soils in this soil survey can be used in planning future land use patterns. Potential productive capacity in farming should be weighed against soil limitations and potential for nonfarm developments.

In some areas, however, soils that are well suited to farming are poorly suited to nonfarm development. These areas are identified as map units 1, 2, 4, and 7 on the general soil map at the back of this publication. The dominant soils in unit 7 are Mangum and Weswood soils. They are subject to flooding.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops

that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management(*5*). The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed soil map units."

rangeland

Dan Caudle, range conservationist, Soil Conservation Service, assisted in preparing this section.

About 79 percent of Clay County is rangeland. More than half of the farm income is derived from livestock, principally cattle. Cow-calf-steer operations are dominant in the county. The average size of ranches is about 1,000 acres.

On many ranches the forage produced on rangeland is supplemented by crop stubble and small grain. In winter the native forage is often supplemented with protein concentrate. Creep feeding of calves and yearlings to increase market weight is practiced on some ranches.

The native vegetation in many parts of the survey area has been greatly depleted by continued excessive use. Much of the acreage that was once open grassland is now covered with brush, weeds, and cactus. The amount of forage produced may be less than half of that originally produced. Productivity of the range can be increased by using management practices that are effective for specific kinds of soil and range sites.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 8 shows, for each soil, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. Explanation of the column headings in table 8 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre

of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, reduction of undesirable brush species, conservation of water, and control of water erosion and soil blowing. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

In the northern part of the county most of the soils are deep and loamy. These soils support tall grasses, and potential productivity is high. In much of the southern part of the county, the soils are loamy. They are moderately deep over sandstone or have a clayey subsoil. These soils have medium potential for range.

The major management concern on most of the rangeland is control of grazing so that the kinds and amounts of plants that make up the potential plant community are reestablished. Controlling brush is an important management concern. If sound range management based on soil survey information and rangeland inventories is applied, the potential is good for increasing the productivity of range in the area.

recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty

when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

wildlife habitat

Ed M. Schwille, biologist, Soil Conservation Service, assisted in preparing this section.

Clay County wildlife can be divided into five categories: non-game, small game, big game, waterfowl, and furbearers. Non-game includes numerous songbirds, herons, raptors, and armadillo. Bobwhite quail, mourning dove, cottontail rabbit, jackrabbit, and squirrel are considered small game. Big game is limited to white-tailed deer located mainly in the southern portion of the county and along the Red River. Waterfowl consists of ducks that utilize lakes and ponds, and geese that feed on grain fields. The most common furbearers are raccoon, coyote, red fox, and bobcat. A few beaver, mink, and muskrat are found along the major streams.

Hardwood trees located along perennial and intermittent streams, draws, and escarpments provide food, nesting and roosting sites, travel lanes, and escape cover for wildlife throughout the county.

Sports fishing is limited to private lakes and farm ponds and to one public lake. Most fish are warm-water species such as black bass, channel catfish, sunfish, crappie, white bass, carp, flathead catfish, bullhead catfish, and shad.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, brome, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are mountainmahogany, bitterbrush, snowberry, and big sagebrush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, deer, sage grouse, meadowlark, and lark bunting.

engineering

John G. Adams, Jr., civil engineer, Soil Conservation Service, assisted in preparing this section.

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed

soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, and depth to a high water table affect the traffic supporting capacity.

sanitary facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils.

Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* . The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 13 provide for probable sources and are based on probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 13.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount

of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

physical and chemical properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and

sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.
7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to wind erosion.

soil and water features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease

of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*6*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 18, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Fluvent (*Fluv,* meaning river, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Ustifluvents (*Usti*, meaning burnt plus *fluvent*, the suborder of the Entisols that have an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Ustifluvents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-silty, mixed (calcareous), thermic Typic Ustifluvents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series. An example is the Yomont series, a member of the coarse-silty, mixed (calcareous), thermic family of Typic Ustifluvents.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil that is typical of the series in the survey area, is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*4*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*6*). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Altus series

The Altus series consists of deep, well drained, loamy soils on uplands. These soils formed in calcareous, loamy sediment. They have a seasonal high water table at a depth of 3 to 6 feet. Slope ranges from 0 to 3 percent.

Typical pedon of Altus fine sandy loam, 0 to 3 percent slopes; from the town of Charlie, 0.8 mile north on county road and 0.4 mile west, 200 feet west in rangeland:

A1—0 to 12 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2)

moist; weak granular structure; slightly hard, very friable; calcareous; moderately alkaline; clear smooth boundary.
B21t—12 to 24 inches; very pale brown (10YR 7/4) sandy clay loam, yellowish brown (10YR 5/4) moist; moderate fine subangular blocky structure; very hard, friable; few patchy clay films; calcareous; moderately alkaline; clear smooth boundary.
B22t—24 to 50 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; moderate fine subangular blocky structure; very hard, friable; few patchy clay films; calcareous; moderately alkaline; clear smooth boundary.
IIC—50 to 80 inches; white (10YR 8/1) clay, light gray (10YR 7/1) moist; massive; extremely hard, firm; 35 percent, by volume, soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness. In places, the water table is at a depth of about 3 feet for short intervals during wet periods when the vegetation is dormant.

The A horizon is 12 to 20 inches thick. It is grayish brown, brown, or dark grayish brown. The B horizon is 20 to 38 inches thick. It is yellowish brown, very pale brown, or brown. The C horizon is white, pink, or yellowish red.

The Altus soils in Clay County are taxadjuncts to the Altus series. They are calcareous throughout the profile and have a mollic epipedon 12 to 20 inches thick. Most areas of these soils are underlain with a buried, calcareous, clayey layer at a depth of 40 to 60 inches. This layer tends to restrict drainage and causes a perched water table to form during wet seasons. However, use, management, and behavior are similar to the Altus series.

Anocon series

The Anocon series consists of deep, well drained, loamy soils on uplands. These soils formed in loamy, calcareous, local alluvium. Slope ranges from 0 to 3 percent.

Typical pedon of Anocon loam in an area of Renfrow-Kirkland-Anocon association, nearly level; from the junction of U.S. Highways 82 and 287 and Farm Road 1197 in the town of Henrietta, 5 miles north on Farm Road 1197, 6 miles east and north on county road, and 100 feet east in rangeland:

A1—0 to 13 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak granular structure; slightly hard, very friable; many roots; slightly acid; clear smooth boundary.
B1—13 to 19 inches; reddish brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; moderate fine subangular blocky structure; hard, firm; many roots; many fine pores; slightly acid; clear smooth boundary.
B21t—19 to 30 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate fine blocky structure; very hard, firm; common roots; common fine pores; few thin patchy clay films; neutral; gradual smooth boundary.
B22t—30 to 54 inches; yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; few fine faint reddish, yellowish, and grayish mottles; moderate fine blocky structure; very hard, firm; few fine roots; few fine pores; few fine black concretions; few thin patchy clay films on peds; noncalcareous; mildly alkaline; gradual smooth boundary.
B3—54 to 80 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure; hard, friable; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. The mollic epipedon is 10 to 19 inches thick and includes the B1 horizon in some pedons. The A horizon is 10 to 14 inches thick. It is brown, grayish brown, or dark grayish brown and is slightly acid or neutral.

The B1 horizon is 8 to 13 inches thick. It is slightly acid or neutral.

The B21t horizon is 8 to 15 inches thick. It is reddish brown or brown. The B22t horizon is 18 to 25 inches thick. It is yellowish brown, reddish brown, or brown. Some pedons have yellowish and grayish mottles. The B2t horizon is slightly acid through mildly alkaline.

The B3 horizon is yellowish red or reddish yellow. It is mildly alkaline or moderately alkaline.

Bastrop series

The Bastrop series consists of deep, well drained, loamy soils on uplands. These soils formed in loamy sediment. Slope ranges from 0 to 8 percent.

Typical pedon of Bastrop fine sandy loam, 1 to 3 percent slopes; from the town of Henrietta, 11.6 miles east on U.S. Highway 82, 6.5 miles north on Farm Road 2332, 1.8 miles west and north on county road, and 800 feet west in a cultivated field:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.
B21t—8 to 32 inches; reddish brown (5YR 4/4) sandy clay loam; dark reddish brown (5YR 3/4) moist; moderate fine subangular blocky structure; hard, friable; thin patchy clay films on ped surfaces; common fine and very fine pores; slightly acid; gradual smooth boundary.
B22t—32 to 40 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; moderate fine subangular blocky structure; hard, friable; thin patchy

clay films on ped surfaces; common fine and very fine pores; neutral; gradual smooth boundary.
B23t—40 to 64 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; moderate fine subangular blocky structure; hard, friable; thin patchy clay films on ped surfaces; few fine and very fine pores; mildly alkaline; gradual smooth boundary.
B24t—64 to 80 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; weak subangular blocky structure; hard, friable; noncalcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness.

The A horizon is 6 to 9 inches thick. It is brown or dark grayish brown and is slightly acid or neutral.

The B2t horizon is reddish brown, red, or yellowish red. It ranges from slightly acid in the upper part to moderately alkaline in the lower part.

Bluegrove series

The Bluegrove series consists of moderately deep, well drained, loamy soils on uplands. These soils formed in material weathered from sandstone. Slope ranges from 1 to 5 percent.

Typical pedon of Bluegrove loam in an area of Bluegrove-Stoneburg association, gently sloping; 2 miles southwest of Arrowhead State Park to headquarters of a large ranch and 1 mile east in rangeland:

A1—0 to 6 inches; brown (7.5YR 4/4) loam, dark brown (7.5YR 3/2) moist; weak granular structure; slightly hard, very friable; many roots; slightly acid; clear smooth boundary.
B21t—6 to 14 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate medium subangular blocky structure; hard, firm; thin continuous clay films on peds; few fine black concretions; slightly acid; gradual irregular boundary.
B22t—14 to 30 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate medium subangular blocky structure; hard, firm; thin patchy clay films on peds; few fine black concretions; 10 percent weakly cemented sandstone fragments; neutral; gradual irregular boundary.
Cr—30 to 48 inches; weakly cemented, gray and red sandstone.

The solum ranges from 20 to 40 inches in thickness.

The A horizon is 5 to 12 inches thick. It is reddish brown, brown, or dark brown loam or fine sandy loam and is medium acid through neutral.

The B2t horizon is reddish brown, yellowish red, or red. It is sandy clay, clay loam, or clay and is slightly acid through mildly alkaline. In the lower part of this horizon, mottles range from none to common.

The Cr horizon is weakly cemented to strongly cemented sandstone. It is interbedded with clayey shale in some pedons.

Bonti series

The Bonti series consists of moderately deep, well drained, loamy soils on uplands. These soils formed in material weathered from sandstone. Slope ranges from 1 to 5 percent.

Typical pedon of Bonti fine sandy loam, 1 to 5 percent slopes; from the town of Vashti, 3.6 miles south and east on Farm Road 1288, 1.4 miles east on county road, and 130 feet north in rangeland:

A1—0 to 4 inches; dark yellowish brown (10YR 4/4) fine sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine subangular blocky structure; slightly hard, friable; many roots; neutral; clear smooth boundary.
A2—4 to 6 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; weak subangular blocky structure; slightly hard, friable; many roots; neutral; abrupt smooth boundary.
B21t—6 to 19 inches; red (2.5YR 4/6) sandy clay, dark red (2.5YR 3/6) moist; moderate fine blocky structure; very hard, firm; common roots; common thin continuous clay films; medium acid; gradual smooth boundary.
B22t—19 to 29 inches; red (2.5YR 5/6) sandy clay; red (2.5YR 4/6) moist; moderate medium blocky structure; very hard, firm; few fine roots; common thin continuous clay films; few sandstone fragments; slightly acid; abrupt irregular boundary.
B3—29 to 36 inches; interbedded yellowish red (5YR 5/6) sandy clay and yellow (10YR 7/6) weakly cemented sandstone; slightly acid; abrupt irregular boundary.
R—36 to 40 inches; yellowish sandstone; weakly cemented when moist, strongly cemented when dry.

The solum ranges from 20 to 40 inches in thickness. It coincides with the depth of sandstone.

The A horizon ranges from 0 to about 15 percent, by volume, fragments of sandstone 1/8 inch to 20 inches in diameter. The A1 horizon is 2 to 6 inches thick. It is brown, yellowish brown, or dark yellowish brown and is neutral through medium acid. The A2 horizon is 0 to 6 inches thick. It is brown, pale brown, light yellowish brown, light brown, grayish brown, or reddish yellow and is neutral through medium acid.

The Bt horizon ranges from 0 to 15 percent coarse fragments, mainly less than 3 inches in diameter. The B21t horizon is red, yellowish red, reddish brown, or light reddish brown. The B22t horizon is red, yellowish red, reddish brown, or light reddish brown and commonly has a few dark red, reddish yellow, strong brown, or yellowish brown mottles. It is strongly acid through slightly acid.

The B3 horizon is 0 to 10 inches thick. It is red, yellowish red, reddish brown, or light reddish brown and is mottled in shades of red, yellow, and brown. The B3 horizon is strongly acid through slightly acid. Coarse fragments in this horizon range from 15 to as much as 50 percent. The fragments occur as discontinuous remnant stone lines of sandstone.

The R layer is yellowish or reddish, strongly cemented to indurated sandstone.

Callahan series

The Callahan series consists of moderately deep, well drained, loamy soils on uplands. These soils formed in material weathered from shale. Slope ranges from 5 to 8 percent.

Typical pedon of Callahan loam in an area of Nebgen-Grandfield-Callahan association, sloping; from intersection of U.S. Highway 82 and Farm Road 1197 in the town of Henrietta, 3.2 miles east on U.S. Highway 82, 0.95 mile northwest on county road, and 100 feet east in rangeland:

A1—0 to 10 inches; brown (7.5YR 5/4) loam, dark brown (7.5YR 3/4) moist; weak granular structure; slightly hard, very friable; many roots; common pores; neutral; clear smooth boundary.

B2t—10 to 25 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate medium blocky structure; very hard, very firm; common roots; thin patchy clay films on faces of peds; mildly alkaline; clear smooth boundary.

B2tca—25 to 35 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate medium blocky structure; very hard, very firm; few roots; few fine pores; thin patchy clay films on faces of peds; calcareous; moderately alkaline; clear smooth boundary.

Cr—35 to 60 inches; red (2.5YR 4/6) clayey shale; massive; very hard, very firm; calcareous; moderately alkaline.

The solum ranges from 24 to 40 inches in thickness. Secondary carbonates are at a depth of 18 to 28 inches.

The A1 horizon is 4 to 10 inches thick. It is reddish brown, brown, or light brown and is slightly acid through mildly alkaline. The A1 horizon is 0 to 15 percent, by volume, stones that are more than 3 inches in diameter.

The Bt horizon is reddish brown, dark reddish brown, yellowish red, brown, or light reddish brown and is mildly alkaline or moderately alkaline.

Some pedons have a B3ca horizon that is similar in color and texture to the Bt horizon.

The C horizon is clayey shale interbedded with thin strata of sandstone.

Chaney series

The Chaney series consists of deep, moderately well drained soils on uplands. These soils formed in sandy material. Slope ranges from 0 to 3 percent.

Typical pedon of Chaney loamy fine sand, 0 to 3 percent slopes; from intersection of Texas Highway 148 and Farm Road 172 about 10 miles south of the town of Henrietta, 4.9 miles west on Farm Road 172, 1.5 miles south on county road, 0.6 mile east on county road, and 100 feet north in bermudagrass pasture:

A1—0 to 6 inches; dark yellowish brown (10YR 4/4) loamy fine sand, dark yellowish brown (10YR 3/4) moist; single grain; loose, very friable; neutral; clear smooth boundary.

A2—6 to 15 inches; yellowish brown (10YR 5/4) loamy fine sand, dark yellowish brown (10YR 4/4) moist; single grain; loose, very friable; mildly alkaline; clear smooth boundary.

B21t—15 to 25 inches; yellowish brown (10YR 5/4) sandy clay; dark yellowish brown (10YR 4/4) moist; few fine reddish yellow (7.5YR 6/6) mottles; moderate fine subangular blocky structure; hard, firm; mildly alkaline; gradual wavy boundary.

B22t—25 to 45 inches; gray (10YR 5/1) sandy clay, dark gray (10YR 4/1) moist; common fine reddish yellow (7.5YR 6/6) mottles; moderate fine subangular blocky structure; hard, firm; noncalcareous; mildly alkaline; gradual wavy boundary.

B3—45 to 65 inches; light gray (10YR 7/1) sandy clay loam, gray (10YR 6/1) moist; common fine brownish yellow (10YR 6/6) mottles; weak coarse subangular blocky structure; slightly hard, friable; noncalcareous; mildly alkaline; gradual wavy boundary.

C—65 to 80 inches; light gray (10YR 7/1) and brownish yellow (10YR 6/6) sandy clay loam; slightly hard, friable; noncalcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness.

The A horizon is 10 to 20 inches thick. The A1 horizon is light brown, brown, grayish brown, dark grayish brown, yellowish brown, dark yellowish brown, pale brown, or light yellowish brown. The A2 horizon is neutral or mildly alkaline and has value that is one or more units higher than the A1 horizon.

The B2t horizon is brownish yellow, yellowish brown, or yellowish red and has mottles in shades of red, yellow, and gray. It is sandy clay, clay, or clay loam that has 35 to 50 percent content of clay. The B2t horizon is mildly alkaline or moderately alkaline. The B3 horizon has coarse brownish yellow, red, pale brown, light gray, or gray mottles. It is sandy clay loam or sandy clay and is medium acid through moderately alkaline.

The C horizon ranges from sandy loam through shaly clay. It is medium acid through moderately alkaline.

The Chaney soils in Clay County are taxadjuncts to the Chaney series. The Bt horizon is dominantly gray without prominent reddish mottles and is mildly alkaline or moderately alkaline. However, use, management, and behavior are similar to the Chaney series.

Cisco series

The Cisco series consists of deep, well drained, loamy soils on uplands. These soils formed in loamy alluvium. Slope ranges from 1 to 5 percent.

Typical pedon of Cisco fine sandy loam, 1 to 5 percent slopes; from intersection of Texas Highway 148 and Farm Road 172 about 10 miles south of the town of Henrietta, 1.9 miles east on county road, 0.6 mile south, 1.0 mile east on private road, and 400 feet north in rangeland:

A1—0 to 9 inches; brown (7.5YR 5/2) fine sandy loam, dark brown (7.5YR 4/2) moist; weak granular structure; slightly hard, very friable; many roots; slightly acid; clear smooth boundary.

B21t—9 to 20 inches; reddish brown (2.5YR 4/4) sandy clay loam, dark reddish brown (2.5YR 3/4) moist; moderate fine subangular blocky structure; very hard, friable; many roots; thin continuous clay films; slightly acid; clear smooth boundary.

B22t—20 to 36 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; moderate fine subangular blocky structure; very hard, friable; common roots; thin continuous clay films; neutral; gradual smooth boundary.

B3—36 to 50 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; moderate fine subangular blocky structure; hard, friable; few roots; thin patchy clay films; moderately alkaline; gradual smooth boundary.

C—50 to 80 inches; yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; massive; slightly hard, very friable; moderately alkaline.

The solum is 30 to 60 inches thick.

The A horizon is 5 to 10 inches thick. It is brown and reddish brown and is slightly acid or neutral.

The Bt horizon is 20 to 45 inches thick. It is reddish brown, red, yellowish red, and reddish yellow and is slightly acid through mildly alkaline.

The C horizon is reddish yellow, yellowish red, and red and is mildly alkaline or moderately alkaline.

Darnell series

The Darnell series consists of shallow, somewhat excessively drained, loamy soils on uplands. These soils formed in material weathered from sandstone. Slope ranges from 1 to 12 percent.

Typical pedon of Darnell fine sandy loam in an area of Darnell-Truce complex, 3 to 12 percent slopes; from intersection of Farm Road 174 and Farm Road 1288 in the town of Vashti, about 2.0 miles south, 1.5 miles east, and 0.1 mile south on Farm Road 1288, and 100 feet east in rangeland:

A1—0 to 6 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable; many roots; 3 percent, by volume, sandstone fragments less than 3 inches in diameter; medium acid; gradual smooth boundary.

B2—6 to 14 inches; reddish yellow (7.5YR 6/6) fine sandy loam, strong brown (7.5YR 5/6) moist; weak granular structure; slightly hard, very friable; many roots; 5 percent, by volume, fragments of sandstone less than 1 inch in diameter; medium acid; gradual wavy boundary.

Cr—14 to 30 inches; reddish yellow (7.5YR 6/6) sandstone, strong brown (7.5YR 5/6) moist; difficult to auger; slightly acid.

The solum ranges from 10 to 20 inches in thickness.

The A horizon is 4 to 10 inches thick. It is brown, reddish brown, grayish brown, or dark grayish brown and is neutral to medium acid. The A horizon is 1 to 15 percent, by volume, sandstone fragments 3 to 12 inches in diameter.

The B horizon is 4 to 12 inches thick. It is reddish brown, light reddish brown, yellowish red, reddish yellow, brown, light brown, pink, pale brown, very pale brown, light yellowish brown, or yellow. The B horizon is neutral through medium acid and is 0 to 15 percent, by volume, sandstone fragments less than 3 inches in diameter.

The C horizon is weakly cemented to strongly cemented sandstone. It is red, light red, reddish brown, yellowish red, reddish yellow, strong brown, or brown.

Deandale series

The Deandale series consists of deep, moderately well drained, loamy soils on uplands. These soils formed in calcareous, clayey materials. Slope ranges from 0 to 3 percent.

Typical pedon of Deandale silt loam, 0 to 1 percent slopes; from the county line of Clay and Wichita Counties on Texas Highway 79, 2.1 miles east and 100 feet north in pasture:

A1—0 to 9 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

B21t—9 to 23 inches; dark brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate medium blocky structure; very hard, very firm; few silt coatings between peds; continuous clay films on peds; few fine hard calcium carbonate concretions; noncalcareous; moderately alkaline; gradual smooth boundary.

B22t—23 to 54 inches; brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; moderate medium blocky structure; very hard, very firm; nearly continuous clay films on peds; few fine hard calcium carbonate concretions; few crystals of salt; calcareous; moderately alkaline; gradual wavy boundary.
B23t—54 to 80 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; moderate medium blocky structure; very hard, very firm; patchy clay films; few black concretions; few fine hard calcium carbonate concretions; few soft masses of calcium carbonate; few salt crystals; calcareous; moderately alkaline; gradual wavy boundary.

The solum is more than 60 inches thick.

The A horizon is 8 to 17 inches thick. It is grayish brown or brown and is slightly acid or neutral.

The upper part of the B2t horizon is brown, dark brown, or dark grayish brown; the middle part is reddish brown, brown, grayish brown, or dark grayish brown; and the lower part is red, reddish brown, yellowish red, brown, grayish brown, dark grayish brown, or light olive brown. The B2t horizon ranges from neutral in the upper part to moderately alkaline in the lower part.

The Cr horizon, if present, ranges from red to yellowish red. It is predominantly clayey shale but is stratified with more loamy material in some pedons.

Devol series

The Devol series consists of deep, well drained, sandy soils on uplands. These soils formed in sandy windblown sediment. Slope ranges from 0 to 8 percent.

Typical pedon of Devol loamy fine sand, 0 to 3 percent slopes; from the town of Thornberry, 1.4 miles north on Farm Road 171 and 150 feet east in pecan orchard:

Ap—0 to 13 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 4/4) moist; single grain; loose; slightly acid; clear smooth boundary.
B2t—13 to 32 inches; reddish brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak granular structure; slightly hard, very friable; many pores; coated sand grains; neutral; gradual smooth boundary.
B3—32 to 55 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak granular structure; slightly hard, very friable; many pores; coated sand grains; mildly alkaline; gradual smooth boundary.
C—55 to 80 inches; yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6) moist; single grain; loose; mildly alkaline.

The solum ranges from 45 to 60 inches in thickness.

The A1 horizon is 13 to 18 inches thick. It is light brown or brown loamy fine sand or fine sandy loam.

The B21t horizon is 10 to 24 inches thick. It is reddish brown to yellowish red to brown and is slightly acid or neutral.

The B3 horizon is 8 to 24 inches thick. It is reddish brown, yellowish red, or brown and is neutral or mildly alkaline.

The C horizon is reddish yellow or yellowish red and is neutral or mildly alkaline.

Buried layers of sandy clay loam that have chroma of 3 or 4 are in some pedons.

Duffau series

The Duffau series consists of deep, well drained, sandy soils on uplands. These soils formed in sandy or loamy materials or in material weathered from weakly cemented sandstone. Slope ranges from 1 to 5 percent.

Typical pedon of Duffau loamy fine sand, 1 to 5 percent slopes; from intersection of Texas Highway 148 and Farm Road 1883 about 13 miles south of the town of Henrietta, 0.8 mile west on Farm Road 1883, 0.6 mile north on county road, and 75 feet east in brushy rangeland:

A1—0 to 7 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) moist; weak fine granular structure; loose; many roots; slightly acid; clear smooth boundary.
A2—7 to 14 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 4/4) moist; weak fine granular structure; loose; many roots; neutral; clear smooth boundary.
B21t—14 to 24 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; moderate fine subangular blocky structure; hard, friable; common fine roots; common fine pores; thin patchy clay films; few fine black concretions; neutral; gradual smooth boundary.
B22t—24 to 38 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak coarse subangular blocky structure; hard, friable; few roots; common fine pores; few fine black concretions; thin patchy clay films; neutral; gradual smooth boundary.
B23t—38 to 68 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; reddish, yellowish, and brownish mottles; weak coarse subangular blocky structure; hard, friable; few roots; few fine pores; thin patchy clay films; neutral; gradual smooth boundary.
C—68 to 80 inches; reddish yellow (7.5YR 6/8) fine sandy loam, strong brown (7.5YR 5/6) moist; massive; slightly hard, friable; mildly alkaline.

The solum ranges from 60 to about 80 inches in thickness. Content of fine pebbles ranges from none to few throughout the solum.

The A1 horizon is 2 to 8 inches thick. It is yellowish brown, pale brown, light brown, brown, dark grayish

brown, or grayish brown. The A2 horizon is present under native vegetation and has value that is 1 to 3 units lighter in color than the A1 horizon. The A2 horizon is 4 to 12 inches thick. It is slightly acid or neutral.

The B21t, B22t, and B23t horizons are reddish brown, yellowish red, reddish yellow, red, or strong brown. The B23t horizon contains reddish, yellowish, or brownish mottles. These horizons are neutral or mildly alkaline.

The C horizon is sandy clay loam, fine sandy loam, or weakly cemented sandstone interbedded with shale.

Enterprise series

The Enterprise series consists of deep, well drained, loamy soils on uplands. These soils formed in calcareous, loamy, eolian sediment. Slope ranges from 0 to 20 percent.

Typical pedon of Enterprise very fine sandy loam, 1 to 3 percent slopes; from the town of Charlie, 1.5 miles north on county road and 200 feet west in a cultivated field:

Ap—0 to 9 inches; reddish brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak granular structure; very friable, slightly hard; neutral; abrupt smooth boundary.

A1—9 to 26 inches; reddish brown (5YR 5/4) very fine sandy loam, dark reddish brown (5YR 3/4) moist; weak granular structure; very friable, slightly hard; many very fine pores; mildly alkaline; gradual smooth boundary.

B2—26 to 46 inches; reddish brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak granular structure; slightly hard, very friable; few worm casts; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C—46 to 75 inches; reddish yellow (5YR 6/6) very fine sandy loam, yellowish red (5YR 5/6) moist; massive; slightly hard, very friable; films and threads of calcium carbonate in upper part; calcareous; moderately alkaline.

The depth to calcium carbonate is 11 to 31 inches.

The A horizon is 10 to 36 inches thick. It is brown to reddish brown.

The B2 horizon is 12 to 36 inches thick. It is reddish brown to yellowish red.

The C horizon is reddish yellow to yellowish red.

Gowen series

The Gowen series consists of deep, well drained, loamy, alluvial soils. These soils formed in noncalcareous, loamy materials on flood plains. Slope is 0 to 1 percent.

Typical pedon of Gowen soils, frequently flooded; from the town of Buffalo Springs, 4 miles north to Pleasant Valley Cemetery and 200 feet northeast in rangeland:

A11—0 to 15 inches; brown (7.5YR 4/3) loam, dark brown (7.5YR 3/3) moist; weak fine granular structure; slightly hard, very friable; many roots; neutral; clear smooth boundary.

A12—15 to 24 inches; brown (10YR 4/3) sandy clay loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; hard, friable; many roots; neutral; clear smooth boundary.

C—24 to 60 inches; brown (7.5YR 4/4) loam, dark brown (7.5YR 4/4) moist; many thin strata of fine sandy loam; neutral.

The 10- to 40-inch control section has 20 to 35 percent clay content and has more than 15 percent material coarser than very fine sand.

The A horizon has value of less than 3.5 moist. It is loam, clay loam, sandy clay loam, or fine sandy loam and is 20 to about 50 inches thick. The A horizon is neutral through moderately alkaline and is very dark grayish brown, dark grayish brown, grayish brown, or brown.

The C horizon is brown to yellowish brown loam, clay loam, or sandy clay loam.

Grandfield series

The Grandfield series consists of deep, well drained, loamy soils on uplands. These soils formed in ancient, loamy alluvium. Slope ranges from 1 to 5 percent.

Typical pedon of Grandfield fine sandy loam, 1 to 5 percent slopes; from junction of Texas Highway 148 and U.S. Highway 287, 0.9 mile south and 100 feet east in rangeland:

A1—0 to 7 inches; reddish brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak fine and medium granular structure; slightly hard, very friable; many roots; slightly acid; clear smooth boundary.

B21t—7 to 22 inches; reddish brown (2.5YR 4/4) sandy clay loam, dark reddish brown (2.5YR 3/4) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; hard, friable; thin patchy clay films on surface of peds; many roots; many fine and very fine pores; neutral; gradual smooth boundary.

B22t—22 to 40 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; moderate medium subangular blocky structure; hard, friable; thin patchy clay films on surface of peds; few roots; common fine and very fine pores; neutral; gradual smooth boundary.

B3—40 to 80 inches; light red (2.5YR 6/6) fine sandy loam, red (2.5YR 4/6) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; calcareous; moderately alkaline.

The solum ranges from 50 to more than 72 inches in thickness.

The A horizon is 5 to 12 inches thick. It is reddish brown or brown fine sandy loam or loamy fine sand. The A horizon is slightly acid or neutral.

The Bt horizon is reddish brown in the upper part and yellowish red or red in the lower part. This horizon is slightly acid through mildly alkaline.

The B3 horizon is at a depth of less than 60 inches. It is yellowish red, light red, or red sandy clay loam or fine sandy loam. This horizon is neutral through moderately alkaline.

Kamay series

The Kamay series consists of deep, well drained, loamy soils on uplands. These soils formed in clayey, red-bed material. Slope ranges from 1 to 3 percent.

Typical pedon of Kamay silt loam, 1 to 3 percent slopes; from Arrowhead State Park headquarters, 0.6 mile southwest, 0.4 mile west, and 100 feet south in rangeland:

A1—0 to 9 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; massive; very hard; friable; many roots; slightly acid; abrupt smooth boundary.

B21t—9 to 18 inches; brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate medium blocky structure; very hard, very firm; continuous clay films on peds; mildly alkaline; clear smooth boundary.

B22t—18 to 36 inches; brown (7.5YR 5/4) clay, brown (7.5YR 4/4) moist; moderate medium blocky structure; very hard, very firm; few fine hard and soft calcium carbonate concretions; few fine black concretions; continuous clay films on peds; calcareous; moderately alkaline; gradual wavy boundary.

B23tca—36 to 63 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; moderate medium blocky structure; very hard, firm; many clay films; few fine hard calcium carbonate concretions; few fine black concretions; calcareous; moderately alkaline; diffuse wavy boundary.

Cr—63 to 80 inches; interbedded red and gray clayey shale; noncalcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. Depth to secondary carbonates ranges from 14 to 28 inches.

The A horizon is 5 to 12 inches thick. It is brown, reddish brown, or grayish brown and is slightly acid through mildly alkaline.

The Bt horizon is brown or reddish brown in the upper part and red or yellowish red in the lower part. This horizon is neutral through moderately alkaline.

The Cr horizon is clayey shale or massive clay.

Kirkland series

The Kirkland series consists of deep, well drained, loamy soils on uplands. These soils formed in red clays and shales. Slope ranges from 0 to 2 percent.

Typical pedon of Kirkland silt loam, 0 to 1 percent slopes; from junction of U. S. Highways 82 and 287 in the town of Henrietta, 9 miles north on Farm Road 1197, 0.7 mile east on county road, and 100 feet north in a cultivated field:

Ap—0 to 9 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

A1—9 to 12 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; peds in the lower 2 inches have grayish coatings; moderate fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

B21t—12 to 26 inches; very dark grayish brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; moderate fine blocky structure; extremely hard, very firm; clay films on peds; cracks 0.6 to 0.8 of an inch wide through horizon; neutral; gradual smooth boundary.

B22t—26 to 34 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium blocky structure; extremely hard, very firm; clay films on peds; few fine black concretions; cracks 0.4 to 0.6 of an inch wide through horizon; mildly alkaline; gradual smooth boundary.

B23t—34 to 44 inches; dark brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; moderate medium blocky structure; extremely hard, very firm; nearly continuous clay films on peds; few fine calcium carbonate concretions; few fine black concretions; moderately alkaline; gradual smooth boundary.

B24tca—44 to 66 inches; brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) moist; weak coarse blocky structure; very hard, very firm; few fine concretions and soft masses of calcium carbonate; few fine black concretions; calcareous; moderately alkaline; clear smooth boundary.

B3—66 to 80 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; few gray mottles; weak fine and medium subangular blocky structure; calcareous; moderately alkaline.

The solum is more than 60 inches thick. Depth to secondary carbonates ranges from 30 to 50 inches.

The A horizon is 8 to 14 inches thick. It is brown, grayish brown, or dark grayish brown and is slightly acid or neutral.

The B2t horizon, except the B21t part, is reddish brown, dark brown, yellowish red, brown, grayish brown, and dark grayish brown. It is neutral through moderately

alkaline. The B21t horizon is 12 to 17 inches thick. It is similar to the A1 horizon in color but includes brown and dark grayish brown.

The B3 horizon ranges from reddish to brownish and is mildly alkaline or moderately alkaline.

The Cr horizon, if present, is reddish shale or clay.

Knoco series

The Knoco series consists of very shallow, well drained, clayey soils on uplands. These soils formed in clayey shale. Slope ranges from 1 to 8 percent.

Typical pedon of Knoco clay in an area of Knoco-Owens association, undulating; from the town of Jolly, 6.8 miles south and west on Farm Road 2393 and 1,200 feet north in rangeland:

A1—0 to 5 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate medium and fine blocky structure; very hard, firm; common roots and fine pores; calcareous; moderately alkaline; clear smooth boundary.

Cr—5 to 16 inches; dusky red (10R 3/3) clayey shale, dusky red (10R 3/3) moist; massive; very hard, very firm; few roots in fractures; calcareous; moderately alkaline.

The A horizon is 3 to 12 inches thick. It is weak red, reddish brown, yellowish red, or dark red.

The Cr horizon is red, dusky red, olive, or bluish. These colors are inherited from the original sediment.

Lincoln series

The Lincoln series consists of deep, somewhat excessively drained, loamy soils on bottom lands. Slope ranges from 0 to 3 percent.

Typical pedon of Lincoln fine sandy loam, frequently flooded; from the town of Charlie, 1 mile west on county road, 2.2 miles north, 500 feet east to old farmstead, and 2,500 feet north-northwest in rangeland:

A1—0 to 10 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak granular structure; slightly hard, very friable; many roots; calcareous; moderately alkaline; clear smooth boundary.

C—10 to 60 inches; reddish yellow (5YR 7/6) fine sand, reddish yellow (5YR 6/6) moist; single grain; loose; thin bedding planes of darker strata less than 1 inch thick of clay loam, sandy clay loam, fine sandy loam, and loam; calcareous; moderately alkaline.

The soil is moderately alkaline and generally calcareous throughout the 10- to 40-inch control section. The upper 10 inches is noncalcareous in some places.

The A1 horizon is 6 to 15 inches thick. It is reddish brown or brown.

The C horizon is reddish yellow or pink. It is fine sand or loamy fine sand and has darker strata of fine sandy loam, sandy clay loam, loam, very fine sandy loam, silt loam, or clay loam.

Mangum series

The Mangum series is made up of deep, moderately well drained, loamy or clayey soils on bottom lands. These soils formed in calcareous, clayey alluvium. Slope is 0 to 1 percent.

Typical pedon of Mangum silty clay loam, occasionally flooded; from intersection of Farm Roads 1740 and 2393 near the town of Thornberry, 0.8 mile southwest on Farm Road 1740 and 100 feet west in cropland:

Ap—0 to 6 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; moderate fine subangular blocky structure; hard, firm; common very fine pores; calcareous; moderately alkaline; abrupt smooth boundary.

A1—6 to 10 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; moderate medium and fine subangular blocky structure; hard, firm; common very fine pores; calcareous; moderately alkaline; clear smooth boundary.

B—10 to 40 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; moderate fine and medium angular blocky structure; peds have dull surfaces when dry and shiny surfaces when wet; very hard, very firm; few very fine pores; few films and threads of calcium carbonate; darker surface soil in cracks to a depth of 30 inches; calcareous; moderately alkaline; gradual smooth boundary.

C1—40 to 60 inches; reddish brown (2.5YR 5/4) clay, reddish brown (2.5YR 4/4) moist; massive; very hard, very firm; bedding planes of darker clayey soil; calcareous; moderately alkaline.

The solum is 20 to 50 inches thick. The pedon is calcareous throughout.

The A horizon is 5 to 16 inches thick. It is silty clay loam, silty clay, or clay.

The B horizon is 10 to 36 inches thick. It is reddish brown or red silty clay or clay.

The C horizon is reddish brown or red clay or silty clay.

Minco series

The Minco series consists of deep, loamy, well drained soils on uplands. These soils formed in calcareous, loamy sediment that has been modified by wind. Slope ranges from 0 to 8 percent.

Typical pedon of Minco very fine sandy loam, 1 to 3 percent slopes; from water tower in the town of Byers, 4.8 miles northeast on Texas Highway 79, 0.3 mile north on county road, 0.8 mile north on field road, and 200 feet west in a cultivated field:

Ap—0 to 8 inches; reddish brown (5YR 5/3) very fine sandy loam, dark reddish brown (5YR 3/3) moist; weak granular structure; slightly hard, very friable; medium acid; abrupt smooth boundary.
A1—8 to 17 inches; reddish brown (5YR 5/3) very fine sandy loam, dark reddish brown (5YR 3/3) moist; weak granular structure; slightly hard, very friable; slightly acid; gradual smooth boundary.
B21—17 to 30 inches; reddish brown (5YR 5/3) very fine sandy loam, dark reddish brown (5YR 3/4) moist; weak and moderate fine granular structure; slightly hard, very friable; neutral; gradual smooth boundary.
B22—30 to 50 inches; reddish brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak and moderate fine granular structure; slightly hard, very friable; noncalcareous; mildly alkaline; gradual smooth boundary.
C—50 to 80 inches; yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6) moist; massive; slightly hard, very friable; few films and threads of calcium carbonate; calcareous; moderately alkaline.

The solum is 36 to 60 inches thick.

The A horizon is 10 to 18 inches thick. It is reddish brown or brown and is medium acid through neutral.

The B horizon is red, reddish brown, yellowish red, brown, or light brown. It is neutral through moderately alkaline.

The C horizon is yellowish red, reddish brown, or brown. It is mildly alkaline or moderately alkaline.

Motley series

The Motley series consists of deep, loamy, well drained soils on uplands. These soils formed in calcareous, loamy material. Slope ranges from 0 to 5 percent.

Typical pedon of Motley loam, 1 to 3 percent slopes; from water tower in the town of Byers, 2.3 miles northeast on Texas Highway 79 and 200 feet north in rangeland:

A1—0 to 7 inches; brown (7.5YR 4/3) loam, dark brown (7.5YR 3/3) moist; weak granular structure; slightly hard, very friable; many roots; neutral; clear smooth boundary.
B21t—7 to 15 inches; reddish brown (5YR 4/3) sandy clay loam, dark reddish brown (5YR 3/3) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; hard, friable; thin patchy clay films on peds; many fine and very fine pores; neutral; gradual smooth boundary.
B22t—15 to 33 inches; reddish brown (2.5YR 4/4) sandy clay loam, dark reddish brown (2.5YR 3/4) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; hard, friable; thin patchy clay films; common fine and very fine pores; neutral; gradual smooth boundary.
B23t—33 to 63 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; moderate fine subangular blocky structure; hard, friable; thin patchy clay films on peds; common fine and very fine pores; mildly alkaline; gradual smooth boundary.
B3ca—63 to 80 inches; red (2.5YR 5/6) loam, red (2.5YR 4/6) moist; weak medium subangular blocky structure; calcareous; moderately alkaline.

The solum is more than 60 inches thick.

The A horizon is 6 to 9 inches thick. It is brown or reddish brown.

The B21t horizon is 4 to 11 inches thick. It is brown or reddish brown and is neutral or mildly alkaline.

The B22t and B23t horizons, combined, are 45 to 65 inches thick. They are reddish brown, yellowish red, or red and are neutral through moderately alkaline.

The B3ca horizon and the C horizon are yellowish red or red sandy clay loam or loam.

Nebgen series

The Nebgen series consists of very shallow and shallow, well drained, loamy soils on uplands. These soils formed in material weathered from strongly cemented sandstone. Slope ranges from 3 to 12 percent.

Typical pedon of Nebgen stony fine sandy loam in an area of Nebgen-Grandfield-Callahan association, sloping; from intersection of U.S. Highway 82 and Farm Road 1197 in the town of Henrietta, 3.2 miles east on U.S. Highway 82, 0.9 mile northwest on county road, and 100 feet east in rangeland:

A1—0 to 6 inches; brown (7.5YR 5/4) stony fine sandy loam, dark brown (7.5YR 4/4) moist; weak granular structure; slightly hard, very friable; many roots; few sandstone fragments; slightly acid; clear irregular boundary.
R—6 inches; reddish yellow (7.5YR 7/6) sandstone, reddish yellow (7.5YR 6/6) moist; weakly cemented moist, strongly cemented dry; neutral.

The solum is 4 to 14 inches thick over strongly cemented sandstone. The solum is slightly acid or neutral. Ten to 25 percent of the surface is covered with sandstone fragments more than 3 inches in diameter.

The A horizon is light reddish brown, reddish brown, brown, or dark brown.

Some pedons have a Cr horizon that is 50 to 75 percent broken sandstone and 25 to 50 percent sandy loam.

The R layer is strongly cemented sandstone.

Nipsum series

The Nipsum series consists of deep, well drained, loamy soils on uplands. These soils formed in clayey alluvium. Slope ranges from 0 to 2 percent.

Typical pedon of Nipsum clay loam, 0 to 2 percent slopes; from intersection of Farm Roads 810 and 1740 about 8 miles northwest of the town of Petrolia, 2.5 miles southwest on Farm Road 1740, 0.6 mile north on county road, and 1,600 feet northeast in a cultivated field:

Ap—0 to 6 inches; brown (7.5YR 5/4) clay loam, dark reddish brown (5YR 3/3) moist; weak subangular blocky structure; hard, firm; mildly alkaline; abrupt smooth boundary.
A12—6 to 30 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate medium blocky structure; very hard, firm; common pores; moderately alkaline; calcareous in lower 6 inches; gradual smooth boundary.
Bca—30 to 60 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate medium blocky structure; very hard, firm; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.
C—60 to 80 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; massive; hard, firm; calcareous; moderately alkaline.

The solum ranges from 40 to more than 60 inches in thickness. The mollic epipedon ranges from 20 to 40 inches in thickness. Depth to calcareous material ranges from 0 to 28 inches.

The A horizon is 20 to 40 inches thick. It is brown, dark brown, reddish brown, or dark reddish brown and is mildly alkaline or moderately alkaline. Some pedons have thin loamy strata that have value of more than 3.5.

The Bca horizon is reddish brown or brown.

The C horizon is reddish brown or yellowish red.

Owens series

The Owens series consists of shallow, well drained, clayey soils on uplands. These soils formed in shaly clay. Slope ranges from 1 to 25 percent.

Typical pedon of Owens clay in an area of Knoco-Owens association, undulating; from the town of Jolly, 6.8 miles south and west on Farm Road 2393 and 1,200 feet north in rangeland:

A1—0 to 6 inches; reddish brown (2.5YR 5/4) clay, reddish brown (2.5YR 4/4) moist; weak medium and fine subangular blocky structure; very hard, very firm; thin surface crust; common roots; few fine pores below surface crust; calcareous; moderately alkaline; gradual smooth boundary.
B2ca—6 to 15 inches; weak red (10R 4/4) clay, dusky red (10R 3/4) moist; few olive mottles; moderate medium blocky structure; very hard, very firm; common roots; few very fine pores; few films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.
Cr—15 to 30 inches; interbedded weak red and olive clayey shale; massive; very hard, very firm; calcareous; moderately alkaline.

The solum ranges from 10 to 20 inches in thickness.

The A horizon is 3 to 10 inches thick. It is olive, pale olive, olive brown, light olive brown, light yellowish brown, brown, grayish brown, light brownish gray, light reddish brown, reddish brown, or weak red. Sandstone fragments more than 30 inches in diameter cover 0 to 50 percent of the surface and make up 0 to 50 percent of the upper part of the A horizon. The upper few inches in some pedons is noncalcareous.

The B2ca horizon is pale olive, olive brown, light olive brown, grayish brown, light brownish gray, pale brown, brown, yellowish brown, light yellowish brown, reddish brown, light reddish brown, or weak red. Calcium carbonate in the B2ca horizon ranges from barely visible films and threads to about 5 percent by volume soft, powdery masses.

The Cr horizon ranges from olive to weak red shaly clay, clayey shale, or weakly consolidated shale.

Port series

The Port series consists of deep, loamy, well drained soils on bottom lands. These soils formed in calcareous, loamy alluvium. Slope ranges from 0 to 1 percent.

Typical pedon of Port silt loam in an area of Port soils, frequently flooded; from the town of Petrolia, 1 mile southeast on Texas Highway 148, 3.3 miles east on Farm Road 2332, 0.3 mile east on county road, and 100 feet south in rangeland:

A1—0 to 25 inches; brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; moderate medium granular structure; slightly hard, friable; many roots; mildly alkaline; clear smooth boundary.
B21—25 to 44 inches; brown (7.5YR 4/2) silty clay loam, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; hard, firm; common roots; mildly alkaline; gradual smooth boundary.
B22—44 to 50 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; moderate medium subangular blocky structue; hard, firm; few roots; few soft concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.
C—50 to 80 inches; yellowish red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; faint to distinct bedding planes; dominantly calcareous with strata of noncalcareous material; moderately alkaline.

The solum is 30 to 60 inches thick. Depth to secondary carbonates ranges from 20 to 60 inches. The mollic epipedon is more than 20 inches thick and extends in some pedons into the upper part of the B2 horizon.

The A1 horizon is 10 to 36 inches thick. It is weak red, dusky red, very dark gray, dark reddish gray, reddish gray, reddish brown, dark reddish brown, brown, or dark brown silt loam and clay loam.

The B horizon is 15 to 25 inches thick. The B2 horizon and C horizon are similar to the A1 horizon in color but include red, yellowish red, and strong brown.

Renfrow series

The Renfrow series consists of deep, well drained, loamy soils on uplands. These soils formed in calcareous red beds. Slope ranges from 0 to 3 percent.

Typical pedon of Renfrow loam in an area of Renfrow-Kirkland-Anocon association, nearly level; from intersection of U.S. Highway 82 and Farm Road 1197 in the town of Henrietta, 5 miles north on Farm Road 1197, 4 miles east on county road, and 100 feet east in rangeland:

A1—0 to 9 inches; brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; moderate fine granular structure; slightly hard, friable; many roots; slightly acid; clear smooth boundary.

B1—9 to 15 inches; reddish brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; moderate medium and fine subangular blocky structure; hard, firm; many roots; slightly acid; clear smooth boundary.

B21t—15 to 30 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate medium blocky structure; very hard, very firm; nearly continuous clay films; few fine black concretions; cleavage planes have thin silt coatings; neutral; gradual smooth boundary.

B22t—30 to 50 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; moderate medium blocky structure; very hard, very firm; nearly continuous clay films on peds; few black concretions; few silt coatings on cleavage planes in upper part; noncalcareous; moderately alkaline; gradual smooth boundary.

B23t—50 to 80 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; weak coarse blocky structure; very hard, very firm; noncalcareous; moderately alkaline; gradual smooth boundary.

The solum is more than 60 inches thick.

The A horizon is 5 to 12 inches thick. It is brown, dark brown, grayish brown, dark grayish brown, or reddish brown and is slightly acid through mildly alkaline.

The B1 horizon is 3 to 10 inches thick. It is brown or reddish brown and is slightly acid through mildly alkaline. The B2t horizon is reddish brown, yellowish red, or red and is neutral through moderately alkaline.

Some pedons have a Cr horizon of weathered reddish, grayish, or brownish clayey shale.

Ships series

The Ships series consists of deep, moderately well drained, clayey soils on bottom lands. These soils formed in clayey alluvium. Slope is 0 to 1 percent.

Typical pedon of Ships clay, occasionally flooded; from intersection of U.S. Highway 82 and Farm Road 1197 in the town of Henrietta, 1 mile north on Farm Road 1197 and 300 feet east in rangeland:

A11—0 to 5 inches; reddish brown (5YR 5/3) clay, dark reddish brown (5YR 3/3) moist; weak medium and fine blocky structure; extremely hard, very firm, very sticky and plastic; few slickensides; noncalcareous; moderately alkaline; gradual wavy boundary.

A12—5 to 30 inches; reddish brown (5YR 5/3) clay, dark reddish brown (5YR 3/3) moist; weak coarse blocky structure; extremely hard, very firm, very sticky and plastic; intersecting slickensides; noncalcareous; moderately alkaline; gradual wavy boundary.

AC—30 to 50 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; weak coarse blocky structure; extremely hard, very firm, very sticky and plastic; calcareous; moderately alkaline; gradual wavy boundary.

C—50 to 60 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; massive; extremely hard, very firm, very sticky and plastic; few concretions, threads, and films of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 30 to more than 60 inches in thickness. Films, threads, or soft masses of calcium carbonate are at a depth of 28 to more than 60 inches.

The A horizon is 20 to 40 inches thick. It is brown, dark brown, dark reddish gray, reddish brown, or dark reddish brown.

The AC horizon is reddish brown or red. It is 10 to 28 inches thick.

The C horizon is red or reddish brown. Films, threads, and masses of calcium carbonate make up as much as 5 percent of the C horizon.

Stephenville series

The Stephenville series consists of moderately deep, well drained, sandy soils on uplands. These soils formed over sandstone. Slope ranges from 0 to 3 percent.

Typical pedon of Stephenville loamy fine sand, 0 to 3 percent slopes; from the intersection of Texas Highway 148 and Farm Road 172 about 10 miles south of the town of Henrietta, 1.9 miles south on Texas Highway 148 and 200 feet west in rangeland:

A1—0 to 5 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; single grain; loose; many roots; slightly acid; clear smooth boundary.

A2—5 to 15 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist;

single grain; loose; many roots; slightly acid; clear smooth boundary.
B21t—15 to 21 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure; very hard, firm; few black concretions; few roots; distinct clay films on peds; medium acid; clear smooth boundary.
B22t—21 to 33 inches; reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; few reddish brown (5YR 4/4) mottles; moderate medium subangular blocky structure; very hard, firm; many black concretions; few roots; distinct patchy clay films; medium acid; gradual smooth boundary.
Cr—33 to 48 inches; weakly cemented, slightly acid sandstone.

The solum is 20 to 40 inches thick. Thickness of the solum coincides with the depth to bedrock.

The A1 horizon is 3 to 7 inches thick. It is reddish brown, brown, very dark grayish brown, dark grayish brown, grayish brown, pale brown, very pale brown, light yellowish brown, yellowish brown, or dark yellowish brown.

The A2 horizon is 0 to 13 inches thick. It is reddish brown, light reddish brown, brown, pinkish gray, light brown, grayish brown, light brownish gray, pale brown, yellowish brown, light yellowish brown, or very pale brown.

The B2t horizon is reddish brown, red, light reddish brown, light red, yellowish red, or reddish yellow.

The Cr horizon is reddish sandstone that is weakly cemented when dry and weakly resistant to pressure when moist.

Stoneburg series

The Stoneburg series consists of moderately deep, well drained, loamy soils on uplands. These soils formed in material weathered from sandstone. Slope ranges from 1 to 5 percent.

Typical pedon of Stoneburg loam in an area of Stoneburg-Bluegrove association, gently sloping; from the town of Petrolia, 1 mile south on Texas Highway 148, 3.3 miles east on Farm Road 2332, 0.5 mile east on county road, and 100 feet north in rangeland:

A1—0 to 12 inches; brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; hard, very friable; many roots; common worm casts; slightly acid; clear smooth boundary.
B1—12 to 17 inches; reddish brown (5YR 5/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky structure; hard, friable; many roots; common very fine pores; common worm casts; few thin clay films; slightly acid; clear smooth boundary.
B21t—17 to 28 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; hard, firm; common fine pores; common roots; common thin clay films; few fine black concretions; neutral; gradual smooth boundary.
B22t—28 to 38 inches; reddish yellow (7.5YR 6/6) clay loam, strong brown (7.5YR 5/6) moist; few red mottles; moderate medium subangular blocky structure; hard, firm; few fine pores; few roots; common thin clay films; few sandstone fragments in lower part; few black concretions; noncalcareous; mildly alkaline; gradual wavy boundary.
Cr—38 to 50 inches; yellowish and grayish, weakly cemented, neutral sandstone interbedded with clay.

The solum ranges from 20 to 40 inches in thickness.

The A1 horizon is 8 to 13 inches thick. It is grayish brown or brown and is slightly acid or neutral.

The B1 horizon is 0 to 8 inches thick. It is brown or reddish brown and is slightly acid or netural.

The B21t horizon is reddish brown or yellowish red sandy clay loam or clay loam. It is slightly acid or netural. The B22t horizon is yellowish red, reddish yellow, or reddish brown and is slightly acid through mildly alkaline. It has few to common mottles of red, reddish yellow, strong brown, or yellowish brown. The B22t horizon is 0 to 10 percent sandstone fragments less than 3 inches in diameter.

Teller series

The Teller series consists of deep, well drained, loamy soils on uplands. These soils formed in calcareous, loamy sediment. Slope is 0 to 1 percent.

Typical pedon of Teller loam, 0 to 1 percent slopes; from water tower in the town of Byers, 4.3 miles northeast on Texas Highway 79, and 150 feet north in a cultivated field:

Ap—0 to 8 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; weak granular structure; slightly hard, very friable; slightly acid; abrupt smooth boundary.
B21t—8 to 16 inches; dark brown (10YR 4/3) sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak subangular blocky structure; hard, friable; slightly acid; patchy clay films; many pores; clear smooth boundary.
B22t—16 to 36 inches; brown (7.5YR 4/4) sandy clay loam, dark brown (7.5YR 3/4) moist; moderate medium and fine subangular blocky structure; very hard, friable; neutral; thin clay films; common pores; gradual smooth boundary.
B23t—36 to 48 inches; brown (7.5YR 5/4) sandy clay loam, brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; very hard, friable; continuous clay films; neutral; gradual smooth boundary.
B3—48 to 60 inches; yellowish brown (10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist;

weak subangular blocky structure; hard, friable; calcareous; moderately alkaline; diffuse smooth boundary.
C—60 to 80 inches; brownish yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist; calcareous; moderately alkaline.

The solum ranges from 60 to more than 72 inches in thickness. Depth to calcareous material is 45 to 70 inches.

The A horizon is 6 to 10 inches thick. It is brown, grayish brown, dark brown, or dark grayish brown.

The B21t horizon is 6 to 12 inches thick. It is dark brown or dark grayish brown. The B22t and B23t horizons, combined, are 26 to 40 inches thick. They are brown or dark brown.

The B3 horizon is 10 to 15 inches thick. It is brown, light brown, light yellowish brown, yellowish brown, light yellowish brown, or light olive brown.

The Teller soils in Clay County are taxadjuncts to the Teller series. They are mildly alkaline or moderately alkaline in the lower part of the Bt horizon and are calcareous at a depth of 45 to 70 inches. The Bt horizon and the C horizon have hue of 7.5YR and 10YR. However, use and behavior of these soils are similar to those of the Teller series.

Tivoli series

The Tivoli series consists of deep, sandy soils on uplands. These soils formed in calcareous, eolian sand. Slope ranges from 5 to 8 percent.

Typical pedon of Tivoli fine sand; from the town of Charlie, 1.0 mile west on county road, 2.2 miles north, 500 feet east to old farmstead, and 800 feet north in rangeland:

A1—0 to 9 inches; brown (7.5YR 5/4) fine sand, dark brown (7.5YR 3/4) moist; single grain; loose; many roots; noncalcareous; mildly alkaline; clear smooth boundary.
C—9 to 60 inches; reddish yellow (7.5YR 7/6) fine sand, reddish yellow (7.5YR 6/6) moist; single grain; loose; common roots in upper part; calcareous; moderately alkaline.

The pedon is fine sand to loamy fine sand throughout.

The A horizon is 4 to 10 inches thick. It is reddish brown, light reddish brown, brown, light brown, dark grayish brown, grayish brown, yellowish brown, pale brown, light yellowish brown, or brownish yellow.

The C horizon is reddish brown, reddish yellow, brown, light brown, pink, strong brown, reddish yellow, brownish yellow, yellow, or very pale brown.

The Tivoli soils in Clay County are taxadjuncts to the Tivoli series. They are weakly calcareous and moderately alkaline throughout the C horizon. However, use and behavior of these soils are similar to those of the Tivoli series.

Treadway series

The Treadway series consists of deep, well drained, clayey soils on alluvial fans. These soils formed in calcareous, clayey alluvium. Slope ranges from 0 to 2 percent.

Typical pedon of Treadway clay, 0 to 2 percent slopes; from intersection of U.S. Highway 82 and Farm Road 1197 in the town of Henrietta, 5 miles north on Farm Road 1197, 8.6 miles east and north on county road to dead end in road, 0.5 mile south, and 300 feet west in rangeland:

A1—0 to 8 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; weak fine blocky structure; hard, firm; calcareous; moderately alkaline; gradual smooth boundary.
C1—8 to 30 inches; reddish brown (2.5YR 5/4) clay, dark reddish brown (2.5YR 3/4) moist; massive, some weak blocky structure; very hard, firm; few salt crystals; calcareous; moderately alkaline; clear smooth boundary.
C2—30 to 60 inches; reddish brown (2.5YR 5/4) clay, reddish brown (2.5YR 4/4) moist; massive; hard, firm; calcareous; moderately alkaline.

The solum ranges from 20 to 36 inches in thickness. It is moderately alkaline or strongly alkaline throughout.

The A horizon is 5 to 10 inches thick. It is reddish brown or brown.

The C horizon is reddish brown or red. It has weakly expressed to strongly expressed bedding planes and thin strata of coarser material.

Truce series

The Truce series consists of deep, well drained soils. These soils formed in clayey shale. Slope ranges from 1 to 5 percent.

Typical pedon of Truce fine sandy loam in an area of Windthorst-Truce complex, 1 to 5 percent slopes; from the town of Vashti about 3.6 miles south and east on Farm Road 1288, 1.5 miles east on county road, 0.17 mile south, and 100 feet east in rangeland:

A1—0 to 6 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; slightly hard, friable; many roots; neutral; abrupt smooth boundary.
B21t—6 to 17 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate medium and fine blocky structure; extremely hard, very firm; common roots; common clay films; neutral; gradual wavy boundary.
B22t—17 to 24 inches; brown (7.5YR 5/4) clay, brown (7.5YR 4/4) moist; moderate medium blocky structure; extremely hard, very firm; few roots; common clay films; mildly alkaline; gradual wavy boundary.

B31—24 to 39 inches; light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; weak medium blocky structure; extremely hard, very firm; few roots; few clay films; calcareous at a depth of 32 inches; moderately alkaline; gradual wavy boundary.
B32ca—39 to 49 inches; light olive gray (5Y 6/2) clay, olive gray (5Y 5/2) moist; weak blocky structure; extremely hard; few roots; few clay films; 5 percent soft masses of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.
Cr—49 to 60 inches; light olive gray (5Y 6/2) clayey shale, olive gray (5Y 5/2) moist; calcareous; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness. Depth to secondary carbonates ranges from 30 to 40 inches.

The A1 horizon is 2 to 6 inches thick. It is 0 to 25 percent, by volume, fragments of sandstone more than 3 inches in diameter. The A1 horizon is brown, pale brown, yellowish brown, or dark grayish brown. The A2 horizon is 0 to 7 inches thick. It has value of 1 or 2 units lighter in color than the A1 horizon. The A2 horizon is medium acid through neutral.

The B21t horizon is reddish brown, dark reddish brown, red, or yellowish red. The B22t horizon is brown, strong brown, yellowish red, yellowish brown, reddish yellow, or reddish brown.

The B3 horizon is light yellowish brown, yellowish brown, light olive brown, or light olive gray.

The Cr horizon is clayey shale, partially weathered shale, or shaly clay. It is pale olive, olive, olive yellow, light yellowish brown, light brown, light gray, gray, light olive brown, or light olive gray.

Vernon series

The Vernon series consists of moderately deep, well drained, calcareous, clayey soils on uplands. These soils formed in calcareous, clayey, red-bed sediment. Slope ranges from 1 to 5 percent.

Typical pedon of Vernon clay, 1 to 5 percent slopes; from Lake Arrowhead State Park headquarters on Farm Road 1954, 3.2 miles north, 1.5 miles east on Towanda Trace Street in Arrowhead Estates, 0.4 mile south on North Tana Lane Street, and 250 feet west in rangeland:

A1—0 to 6 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate fine subangular blocky structure; very hard, very firm; many roots; few calcium carbonate concretions; calcareous; moderately alkaline; clear smooth boundary.
B21—6 to 17 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; weak and moderate blocky structure; very hard, firm; common roots; few calcium carbonate concretions; calcareous; moderately alkaline; gradual smooth boundary.
B22—17 to 32 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; weak blocky structure; very hard, firm; common calcium carbonate concretions; few particles of clayey shale; calcareous; moderately alkaline; diffused smooth boundary.
Cr—32 to 60 inches; red clayey shale with spots of gray; calcareous; moderately alkaline.

The solum is 20 to 36 inches thick.

The A horizon is 5 to 10 inches thick. It is brown to reddish brown.

The B2 horizon is 10 to 28 inches thick and ranges from reddish brown to red. It has from a few films and threads of calcium carbonate to as much as 10 percent soft masses and concretions of calcium carbonate.

The Cr horizon is red, yellowish red, or reddish brown. It has common olive or gray mottles or strata.

Waurika series

The Waurika series consists of deep, somewhat poorly drained, loamy soils on uplands. These soils formed in clayey sediment. Slope ranges from 0 to 2 percent.

Typical pedon of Waurika silt loam in an area of Renfrow-Waurika complex, 0 to 2 percent slopes; from the county line of Jack and Clay Counties in the town of Newport, 3.3 miles northeast on Texas Highway 59, and 250 feet south in pasture:

A1—0 to 11 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, friable; many roots; slightly acid; clear smooth boundary.
A2—11 to 14 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; hard, friable; common roots; slightly acid; abrupt smooth boundary.
B2t—14 to 39 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium blocky structure; very hard, very firm; common roots; continuous clay films on faces of peds; few concretions of calcium carbonate; neutral; gradual smooth boundary.
B3ca—39 to 65 inches; brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) moist; weak coarse blocky structure; very hard, very firm; few roots; few black concretions; few soft masses and fine concretions of calcium carbonate; calcareous; moderately alkaline; diffuse boundary.
C—65 to 80 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; massive; very hard, firm; few soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 40 to more than 60 inches in thickness. Depth to soft, powdery secondary lime ranges from 28 to 48 inches.

The A1 horizon is 8 to 15 inches thick. It is brown, dark brown, very dark gray, dark gray, gray, very dark

grayish brown, dark grayish brown, or grayish brown and is neutral or slightly acid. The A2 horizon is 1 to 5 inches thick. It has value of 1 or 2 units lighter in color than the A1 horizon. It is neutral or slightly acid.

The B2t horizon is dark brown, brown, very dark gray, dark gray, gray, very dark grayish brown, dark grayish brown, or grayish brown. It is neutral through moderately alkaline.

The B3ca horizon is brown, dark grayish brown, grayish brown, dark gray, or gray.

The C horizon is light brownish gray, light olive brown, reddish brown, or brown.

Weswood series

The Weswood series consists of deep, well drained, calcareous, loamy soils on bottom lands. These soils formed in calcareous, loamy, alluvial sediment. Slope is 0 to 1 percent.

Typical pedon of Weswood silt loam, occasionally flooded; from junction of Farm Roads 1740 and 2392 near the town of Thornberry, 1.9 miles southwest on Farm Road 1740, and 100 feet west in a cultivated field:

Ap—0 to 8 inches; reddish brown (5YR 4/4) silt loam, dark reddish brown (5YR 3/4) moist; weak granular structure; hard, friable; calcareous; moderately alkaline; clear smooth boundary.

B2—8 to 36 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; weak medium subangular blocky structure; hard, friable; moderately alkaline; few films and threads of calcium carbonate that are more evident when dry; calcareous; gradual smooth boundary.

C—36 to 60 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; massive; slightly hard, friable; distinct bedding planes of thin strata of silt loam and very fine sandy loam; calcareous; moderately alkaline.

The solum ranges from 16 to 50 inches in thickness.

The A horizon is brown, dark brown, or reddish brown and is mildly alkaline or moderately alkaline.

The B horizon is 8 to 40 inches thick. It is silt loam or silty clay loam and has clay content of 18 to 35 percent.

The C horizon is silty clay loam or silt loam and has strata of very fine sandy loam less than 2 inches thick.

Weswood Variant

The Weswood Variant consists of deep, well drained, saline loamy soils on bottom lands. These soils formed in loamy, alluvial sediment. Slope is 0 to 1 percent.

Typical pedon of Weswood Variant silt loam in an area of Weswood Variant, occasionally flooded; from the town of Charlie, 2.2 miles east on county road and 100 feet south in rangeland:

A11—0 to 3 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; platy surface crust 0.7 inch thick; hard, friable; saline; noncalcareous; moderately alkaline; abrupt smooth boundary.

A12—3 to 10 inches; reddish brown (5YR 5/4) silty clay loam, dark reddish brown (5YR 3/4) moist; weak coarse prismatic structure parting to moderate medium blocky and subangular blocky; hard, firm; many roots; saline; calcareous; moderately alkaline; clear smooth boundary.

B2—10 to 36 inches; reddish brown (5YR 5/4) silty clay loam, dark reddish brown (5YR 3/4) moist; weak medium blocky structure; hard, firm; common roots; saline; calcareous; moderately alkaline; gradual smooth boundary.

C—36 to 60 inches; yellowish red (5YR 5/6) silt loam, yellowish red (5YR 4/6) moist; massive; distinct bedding planes; hard, friable; few roots; saline; calcareous; moderately alkaline.

The solum ranges from 24 to 48 inches in thickness. Electrical conductivity throughout the solum ranges from 3 to 15 millimhos per centimeter.

The A11 horizon is 2 to 4 inches thick. It is reddish brown, brown, or dark brown silt loam, silty clay loam, or clay loam. The A12 horizon is brown or reddish brown. It is 4 to 12 inches thick.

The B2 horizon is brown or reddish brown. It is 22 to 30 inches thick.

Some pedons have a C horizon of clayey alluvium.

These soils have morphology similar to the Weswood series. However, the electrical conductivity of the soil is 3 to 15 millimhos per centimeter, and the use and management are quite different from the Weswood series. Because of these differences, these soils are considered to be a variant.

Windthorst series

The Windthorst series consists of deep, moderately well drained, loamy soils on uplands. These soils formed in clayey and loamy materials. Slope ranges from 1 to 5 percent.

Typical pedon of Winthorst fine sandy loam in an area of Windthorst-Truce complex, 1 to 5 percent slopes; from the town of Vashti, 3.6 miles south and east on Farm Road 1288, 1.5 miles east on county road, 0.15 mile south, and 100 feet east in abandoned cropland:

A1—0 to 6 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable; many roots; neutral; clear smooth boundary.

A2—6 to 9 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 3/4) moist; weak fine subangular blocky structure; hard, friable; many roots; common fine pores; neutral; abrupt smooth boundary.

B21t—9 to 23 inches; reddish brown (5YR 4/4) sandy clay, dark reddish brown (5YR 3/4) moist; strong fine blocky structure; extremely hard, very firm; common roots; few fine pores; nearly continuous clay films; slightly acid; gradual smooth boundary.

B22t—23 to 33 inches; reddish brown (5YR 4/4) sandy clay, dark reddish brown (5YR 3/4) moist; fine and medium mottles of yellowish red and yellowish brown; moderate coarse blocky structure; extremely hard, very firm; few roots; few pores; nearly continuous clay films; slightly acid; gradual wavy boundary.

B3—33 to 68 inches; coarsely and prominently mottled brownish yellow (10YR 6/6), grayish brown (10YR 5/2), and red (2.5YR 4/6) sandy clay loam; moderate coarse blocky structure; extremely hard, firm; few roots; thin clay films; slightly acid; gradual wavy boundary.

C—68 to 80 inches; mottled yellow, light gray, and red, neutral sandy clay.

The solum ranges from 35 to 70 inches in thickness.

The A horizon is 4 to 12 inches thick. It is brown, pale brown, light brownish gray, grayish brown, yellowish brown, reddish yellow, dark grayish brown, or light yellowish brown. The A2 horizon, if present, has value and chroma of 1 to 2 units higher than the A1 horizon.

The Bt horizon is red, reddish brown, or yellowish red in the upper part and red, reddish brown, or yellowish red in the lower part. The lower part of the Bt horizon has brownish, yellowish, or reddish mottles. The B3 horizon has prominent mottles in shades of red, yellow, brown, and gray.

The C horizon is clay, clayey shale, sandy clay, clay loam, or fine sandy loam and is interbedded in some pedons with weakly cemented sandstone.

Winters series

The Winters series consists of deep, well drained, loamy soils on uplands. These soils formed in calcareous, loamy sediment. Slope ranges from 1 to 3 percent.

Typical pedon of Winters loam, 1 to 3 percent slopes; from intersection of Farm Roads 1740 and 2393 near the town of Thornberry, 0.6 mile southwest on Farm Road 1740, 0.6 mile west on field road, and 100 feet north in a cultivated field:

Ap—0 to 6 inches; reddish brown (5YR 5/4) loam, dark reddish brown (5YR 3/4) moist; weak granular structure; slightly hard, very friable; slightly acid; abrupt smooth boundary.

B21t—6 to 17 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; moderate medium and coarse blocky structure; hard, firm; continuous clay films; neutral; clear smooth boundary.

B22t—17 to 36 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate medium and coarse blocky structure; hard, firm; continuous clay films; neutral; gradual smooth boundary.

B23t—36 to 48 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; moderate medium and fine blocky structure; hard, firm; nearly continuous clay films; noncalcareous; mildly alkaline; gradual smooth boundary.

B24tca—48 to 65 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; moderate fine blocky structure; hard, firm; patchy clay films; few films and threads of calcium carbonate; calcareous spots; moderately alkaline; gradual smooth boundary.

B3—65 to 80 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; weak to moderate subangular blocky structure; hard, firm; few clay films; calcareous; moderately alkaline; diffuse boundary.

The solum is more than 60 inches thick. Depth to films, threads, or masses of calcium carbonate is 30 to 50 inches.

The A1 horizon is 5 to 10 inches thick. It is brown or reddish brown.

The B21t horizon is reddish brown or dark reddish brown clay or sandy clay. The B22t and B23t horizons are red, reddish brown, or yellowish red.

Yomont series

The Yomont series consists of deep, well drained, loamy soils on bottom lands. These soils formed in calcareous, loamy alluvium. Slope ranges from 0 to 3 percent.

Typical pedon of Yomont very fine sandy loam, occasionally flooded; from intersection of Farm Roads 1740 and 2393 near the town of Thornberry, 0.9 mile east on Farm Road 2393 and 200 feet southwest in rangeland:

A1—0 to 7 inches; reddish brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak granular structure; slightly hard, very friable; many roots; calcareous; moderately alkaline; clear smooth boundary.

C—7 to 60 inches; reddish brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak granular structure; slightly hard, very friable; distinct bedding planes; thin strata of silt loam and loamy very fine sand; common roots; common very fine pores; calcareous; moderately alkaline.

The pedon is calcareous throughout.

The A horizon is 7 to 12 inches thick. It is reddish brown to light brown.

The C horizon is reddish brown, light reddish brown, yellowish red, or reddish yellow. It is very fine sandy loam and has strata (bedding planes) of silt loam and loamy very fine sand and occasionally, strata of silty clay loam.

formation of the soils

In this section the factors of soil formation are described and related to the soils in the survey area. In addition, information is given about the processes of soil formation.

factors of soil formation

Soil is the product of the interaction of the five major factors of soil formation. These factors are climate, plant and animal life, parent material, relief, and time. The kind of soil that develops at any point on the earth is determined by these interacting factors.

Climate and plant and animal life are the active forces in soil formation. These forces act on the parent material that has accumulated through the weathering of rock and unconsolidated deposits and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of profile that is developed and, in extreme cases, determines almost entirely the soil's characteristics. Finally, time is needed to change the parent material into a soil with horizons. The amount of time can be long or short, but generally a long time is required for distinct horizons to develop in a soil.

The interrelationship among the five factors of soil formation is complex, and the effect of any one factor is difficult to isolate. Each factor is discussed separately in the paragraphs that follow, but it is the interaction of all these factors, rather than their simple sum, that determines the nature of the soil.

climate

Clay County has a warm-temperate, subhumid climate with hot summers. This climate contributes to the formation of soils in several ways. Expansion at high temperatures and contraction at low temperatures fracture parent rock and soil material and hasten weathering. Patterns of rainfall distribution cause the soils to be alternately wet and dry.

Grandfield and Motley soils have more clay in their lower layers than most soils in the county. Water moving through the soil carries clay particles downward from the surface layer and deposits them as the movement of water slows. As clay accumulates, the water moves more slowly through the subsoil and deposition of clay accelerates. Thus, the process tends to speed up, and the lower layers eventually become clayey. Devol soils are examples of soils that have developed in sandy sediment that was deposited and reworked by wind action.

plant and animal life

Plants, man, animals, insects, bacteria, worms, fungi, and other micro-organisms are important in the formation of soils. Gains or losses in organic matter, nitrogen, and other plant nutrients, and changes in structure and porosity are among the effects of these organisms.

Grasses have had more influence on soil development than other kinds of plants, especially on the dark Motley, Anocon, Kirkland, and Renfrow soils. Grasses provided litter that protected the surface and added organic matter as the soils formed. The grass roots reached deep into the soil and fed on minerals at a lower depth. Minerals and organic matter were distributed throughout the soil as the plants died and decomposed.

The vegetation in the southern part of the county is dominantly oak-savannah. The soils that developed under this kind of vegetation are lower in content of organic matter and have a lighter colored surface layer than those formed under grasses. Among these soils are Bonti, Darnell, Duffau, Truce, and Windthorst soils.

Man influences the kind of vegetation that grows on the soils through his choice of grazing management methods and tillage practices.

parent material

Parent material is the unconsolidated mass from which a soil is formed. It determines the limits of the chemical and mineral composition of the soil. The soils of Clay County formed in parent materials deposited during the Pennsylvanian, Permian, and Quaternary Periods.

Pennsylvanian materials in the county are mainly interbedded sandstones and shales in the southern part of the county. The sandstones are mostly acid, and the shales are dominantly alkaline. The acid Bonti soils are on ridges where the sandstone is near the surface. Truce soils formed in areas where shale is more than 40 inches below the surface. Owens soils, which are shallow, calcareous, and clayey, are on more sloping hillsides where the shale is near the surface.

Permian materials are mainly interbedded alkaline, clayey shales and neutral sandstones. Bluegrove soils and Stoneburg soils are gently sloping and are on ridges where the sandstone is near the surface. Deandale,

Kamay, Kirkland, and Renfrow soils are in lower areas underlain by clayey shales. Quaternary material is in flood plains along creeks and streams and the Red River.

relief

Relief influences soil development through its effect on drainage and runoff. The degree of profile development depends mainly on the average amount of moisture in the soil if other factors are equal. Nearly level soils absorb more moisture and generally have more developed profiles than sloping soils. Some steeper soils erode almost as fast as they form.

Relief also effects the kind and amount of vegetation on a soil. Slopes facing north and east receive less direct sunlight than those facing south and west; consequently, the soils lose less moisture through evaporation. As a result, vegetation is generally denser on soils that have slopes facing north and east.

Soils that are nearly level or slightly concave have less runoff than the more sloping soils. Consequently, they utilize more of the moisture, contain more organic matter, and are darker.

time

Generally a long period of time is required for formation of soils that have distinct horizons. The length of time that parent material has been in place, therefore, is commonly reflected in the degree of development of the soil.

The soils in Clay County range from young to old. The young soils have very little horizon development. The older soils have well expressed horizons.

Yomont soils are young soils that show little development. These soils have evidence of stratification, little horizon development, and little evidence of chemical and physical changes in the stream deposited alluvium.

Windthorst soils are older soils. They have well developed horizons. The bases are mostly leached out, and clay particles have moved downward and accumulated in the subsoil.

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glossary

ABC soil. A soil having an A, a B, and a C horizon.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:
O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.
A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.
B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.
C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from

that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then

multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These

changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-75 at Henrietta, Texas]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	54.4	28.2	41.3	81	5	23	1.28	.31	2.06	3	.8
February---	58.6	31.6	45.1	84	13	34	1.36	.43	2.09	3	.8
March------	66.9	39.4	53.2	92	17	193	1.93	.55	3.02	4	.3
April------	76.6	50.5	63.6	96	29	412	2.73	.78	4.30	4	.0
May--------	83.6	59.9	71.8	101	42	676	4.45	1.78	6.61	6	.0
June-------	91.8	68.5	80.2	103	53	906	3.69	1.53	5.43	4	.0
July-------	97.0	72.8	84.9	108	59	1,082	2.28	.75	3.49	4	.0
August-----	96.9	71.4	84.2	109	60	1,060	2.46	.41	4.01	4	.0
September--	88.9	63.4	76.2	105	46	786	3.78	1.01	5.99	5	.0
October----	79.2	52.1	65.7	97	34	487	3.11	.88	4.88	4	.0
November---	65.6	39.7	52.7	86	21	150	1.75	.44	2.79	3	.1
December---	57.1	31.3	44.3	81	11	24	1.51	.46	2.34	3	.3
Yearly:											
Average--	76.4	50.7	63.6	---	---	---	---	---	---	---	---
Extreme--	---	---	---	111	5	---	---	---	---	---	---
Total----	---	---	---	---	---	5,833	30.33	25.28	35.61	47	2.3

*A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-75 at Henrietta, Texas]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	March 28	April 2	April 13
2 years in 10 later than--	March 20	March 27	April 7
5 years in 10 later than--	March 5	March 16	March 28
First freezing temperature in fall:			
1 year in 10 earlier than--	November 11	November 1	October 27
2 years in 10 earlier than--	November 18	November 7	October 31
5 years in 10 earlier than--	December 2	November 19	November 9

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-75 at Henrietta, Texas]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	240	224	205
8 years in 10	251	232	212
5 years in 10	271	247	225
2 years in 10	292	262	238
1 year in 10	303	270	245

TABLE 4. POTENTIAL AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP

Soil Unit	Extent of Area*	Cultivated Crops	Rangeland	Urban uses	Recreation Uses
	Pct				
1. Stoneburg-Anocon-Kirkland	27	Medium: depth to rock, too clayey.	Medium: depth to rock, too clayey.	Low: shrink-swell, depth to rock, percs slowly, too clayey.	Low: depth to rock, percs slowly, too clayey.
2. Kamay-Bluegrove-Deandale	24	Medium: depth to rock, too clayey.	Medium: depth to rock, too clayey.	Low: shrink-swell, depth to rock, percs slowly, too clayey.	Low: too clayey, depth to rock, percs slowly.
3. Bonti-Windthorst-Truce	18	Medium: slope, depth to rock.	Medium: slope, depth to rock.	Medium: depth to rock, shrink-swell, percs slowly.	Medium: depth to rock, percs slowly.
4. Renfrow-Bluegrove-Waurika	13	Medium: droughty, too clayey.	Medium: droughty, too clayey.	Low: too clayey, shrink-swell, percs slowly.	Low: too clayey, percs slowly.
5. Teller-Minco-Motley	5	High----------	High----------	High----------	High.
6. Devol-Enterprise	3	Medium: too sandy, slope.	High----------	High----------	High.
7. Weswood-Mangum	4	High----------	High----------	Low: floods, shrink-swell.	Low: floods.
8. Ships-Mangum	3	Low: floods, too clayey.	Medium: too clayey.	Low: floods, shrink-swell, percs slowly, too clayey.	Low: floods, shrink-swell, percs slowly, too clayey.
9. Yomont-Lincoln	1	Low: floods, too sandy.	High----------	Low: floods.	Low: floods.

*Two percent of the county is water area.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

[The acreage of those soils in that part of Jefferson and Cotton Counties, Oklahoma, south of the Red River channel to the Texas-Oklahoma boundary, although a part of the Clay County soil survey area, are not included in this table]

Map symbol	Soil name	Acres	Percent
1	Altus fine sandy loam, 0 to 3 percent slopes	460	0.1
2	Bastrop fine sandy loam, 0 to 1 percent slopes	810	0.1
3	Bastrop fine sandy loam, 1 to 3 percent slopes	2,950	0.4
4	Bastrop fine sandy loam, 3 to 5 percent slopes	1,150	0.2
5	Bastrop fine sandy loam, 5 to 8 percent slopes	340	*
6	Bluegrove-Stoneburg association, gently sloping	80,390	11.4
7	Bonti fine sandy loam, 1 to 5 percent slopes	57,690	8.2
8	Chaney loamy fine sand, 0 to 3 percent slopes	820	0.1
9	Cisco fine sandy loam, 1 to 5 percent slopes	6,150	0.9
10	Darnell-Truce complex, 3 to 12 percent slopes	13,790	2.0
11	Deandale silt loam, 0 to 1 percent slopes	14,920	2.1
12	Deandale silt loam, 1 to 3 percent slopes	1,190	0.2
13	Devol loamy fine sand, 0 to 3 percent slopes	4,180	0.6
14	Devol loamy fine sand, 3 to 8 percent slopes	570	0.1
15	Devol fine sandy loam, 0 to 1 percent slopes	3,290	0.5
16	Devol fine sandy loam, 1 to 3 percent slopes	1,840	0.3
17	Duffau loamy fine sand, 1 to 5 percent slopes	2,430	0.3
18	Enterprise very fine sandy loam, 0 to 1 percent slopes	1,510	0.2
19	Enterprise very fine sandy loam, 1 to 3 percent slopes	2,620	0.4
20	Enterprise very fine sandy loam, 3 to 5 percent slopes	560	0.1
21	Enterprise very fine sandy loam, 5 to 8 percent slopes	1,040	0.1
22	Enterprise very fine sandy loam, 8 to 20 percent slopes	1,830	0.3
23	Gowen soils, frequently flooded	17,930	2.5
24	Grandfield loamy fine sand, 0 to 3 percent slopes	1,700	0.2
25	Grandfield fine sandy loam, 1 to 5 percent slopes	12,830	1.8
26	Kamay silt loam, 1 to 3 percent slopes	59,900	8.5
27	Kirkland silt loam, 0 to 1 percent slopes	2,210	0.3
28	Knoco-Owens association, undulating	2,820	0.4
29	Lincoln fine sandy loam, frequently flooded	2,160	0.3
30	Mangum silty clay loam, occasionally flooded	5,890	0.8
31	Mangum clay, occasionally flooded	4,630	0.7
32	Mangum clay, frequently flooded	1,610	0.2
33	Minco very fine sandy loam, 0 to 1 percent slopes	1,450	0.2
34	Minco very fine sandy loam, 1 to 3 percent slopes	2,850	0.4
35	Minco very fine sandy loam, 3 to 5 percent slopes	640	0.1
36	Minco very fine sandy loam, 5 to 8 percent slopes	1,060	0.2
37	Motley loam, 0 to 1 percent slopes	1,430	0.2
38	Motley loam, 1 to 3 percent slopes	3,340	0.5
39	Motley loam, 3 to 5 percent slopes	970	0.1
40	Nebgen-Grandfield-Callahan association, sloping	28,440	4.0
41	Nebgen-Owens complex, 3 to 25 percent slopes	9,460	1.3
42	Nipsum clay loam, 0 to 2 percent slopes	1,660	0.2
43	Port clay loam, occasionally flooded	3,770	0.5
44	Port soils, frequently flooded	31,820	4.5
45	Renfrow-Kirkland-Anocon association, nearly level	82,980	11.8
46	Renfrow-Waurika complex, 0 to 2 percent slopes	40,460	5.7
47	Ships clay, occasionally flooded	8,000	1.1
48	Stephenville loamy fine sand, 0 to 3 percent slopes	3,860	0.5
49	Stoneburg-Bluegrove association, gently sloping	58,680	8.3
50	Teller loam, 0 to 1 percent slopes	7,720	1.1
51	Tivoli fine sand	650	0.1
52	Treadway clay, 0 to 2 percent slopes	10,700	1.5
53	Vernon clay, 1 to 5 percent slopes	19,450	2.8
54	Weswood silt loam, occasionally flooded	11,000	1.6
55	Weswood Variant, occasionally flooded	1,500	0.2
56	Windthorst-Truce complex, 1 to 5 percent slopes	39,200	5.6
57	Winters loam, 1 to 3 percent slopes	2,670	0.4
58	Yomont very fine sandy loam, occasionally flooded	1,480	0.2
59	Yomont soils, frequently flooded	3,950	0.6
	Water areas greater than 40 acres	13,880	2.0
	Total	705,280	100.0

* Less than 0.1 percent.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield figure indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Map symbol and soil name	Cotton lint	Wheat	Grain sorghum	Alfalfa hay	Improved bermudagrass
	Lb	Bu	Bu	Ton	AUM*
1---------- Altus	350	25	45	2.5	5.0
2---------- Bastrop	400	30	70	---	7.0
3---------- Bastrop	350	25	55	---	7.0
4---------- Bastrop	300	20	45	---	5.5
5---------- Bastrop	250	---	40	---	5.5
6:**					
Bluegrove----------	250	25	45	---	3.5
Stoneburg----------	250	20	45	---	5.0
7---------- Bonti	---	---	35	---	3.5
8---------- Chaney	---	---	35	---	6.0
9---------- Cisco	350	---	40	---	5.5
10**---------- Darnell	---	---	---	---	---
Truce	---	---	---	---	---
11---------- Deandale	250	25	30	---	3.5
12---------- Deandale	200	20	25	---	3.0
13---------- Devol	250	20	30	---	5.5
14---------- Devol	---	15	25	---	5.0
15---------- Devol	300	20	35	---	6.0
16---------- Devol	250	20	30	---	5.0
17---------- Duffau	---	---	40	---	6.5
18---------- Enterprise	375	25	45	2	6.0
19---------- Enterprise	350	25	35	2	6.0
20---------- Enterprise	250	20	30	1.5	5.5

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Cotton lint	Wheat	Grain sorghum	Alfalfa hay	Improved bermudagrass
	Lb	Bu	Bu	Ton	AUM*
21--Enterprise	---	15	20	---	4.0
22--Enterprise	---	---	---	---	---
23--Gowen	---	---	---	---	7.0
24--Grandfield	250	20	30	2.0	6.0
25--Grandfield	250	20	30	2.0	4.5
26--Kamay	225	20	25	---	3.0
27--Kirkland	300	30	40	---	5.5
28:**					
Knoco	---	---	---	---	---
Owens	---	---	---	---	---
29. Lincoln	---	---	---	---	5.0
30--Mangum	300	25	25	---	6.0
31--Mangum	150	20	20	---	5.0
32--Mangum	---	---	---	---	4.0
33--Minco	500	35	50	3.5	7.0
34--Minco	450	30	45	3.0	6.5
35--Minco	400	30	40	2.5	5.5
36--Minco	---	25	---	---	5.0
37--Motley	375	25	30	2.0	6.0
38--Motley	350	20	25	1.5	5.5
39--Motley	300	15	20	---	5.0
40:**					
Nebgen	---	---	---	---	---
Grandfield	---	---	---	---	---
Callahan	---	---	---	---	---
41**:					
Nebgen	---	---	---	---	---
Owens	---	---	---	---	---

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Cotton lint	Wheat	Grain sorghum	Alfalfa hay	Improved bermudagrass
	Lb	Bu	Bu	Ton	AUM*
42--- Nipsum	300	25	25	---	---
43--- Port	500	35	50	5.0	7.0
44--- Port	---	---	---	---	7.0
45:**					
Renfrow---	250	25	30	---	3.0
Kirkland---	400	30	40	---	5.5
Anocon---	---	20	45	---	6.0
46:**					
Renfrow---	284	25	33	---	3.7
Waurika---	350	25	40	---	5.0
47--- Ships	200	20	20	---	3.0
48--- Stephenville	---	25	35	---	5.0
49:**					
Stoneburg---	---	20	45	---	5.0
Bluegrove---	200	20	35	---	---
50--- Teller	450	35	55	3.5	7.0
51--- Tivoli	---	---	---	---	---
52--- Treadway	---	---	---	---	---
53--- Vernon	---	10	14	---	---
54--- Weswood	450	30	60	5.0	7.0
55--- Weswood Variant	---	---	---	---	---
56:**					
Windthorst---	---	---	33	---	4.7
Truce---	---	---	30	---	4.0
57--- Winters	250	30	50	---	---
58--- Yomont	350	25	40	2.5	6.0
59--- Yomont	---	---	---	---	6.0

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I	9,980	---	---	---	---
II	214,318	123,374	43,491	44,513	2,940
III	345,428	340,798	4,630	---	---
IV	33,267	33,267	---	---	---
V	23,490	---	23,490	---	---
VI	34,435	19,391	---	15,044	---
VII	30,482	650	---	29,832	---
VIII	---	---	---	---	---

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Map symbol and soil name	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
1---------- Altus	Sandy Loam----------	Favorable	5,000	Little bluestem----------	25
		Normal	4,000	Sand bluestem----------	20
		Unfavorable	3,000	Sideoats grama----------	15
				Blue grama----------	10
				Indiangrass----------	5
				Texas needlegrass----------	5
				Sand lovegrass----------	5
				Sand sagebrush----------	5
2, 3, 4, 5---------- Bastrop	Sandy loam----------	Favorable	6,000	Little bluestem----------	30
		Normal	4,000	Indiangrass----------	10
		Unfavorable	2,500	Sand bluestem----------	10
				Texas needlegrass----------	5
				Arizona cottontop----------	5
				Sideoats grama----------	5
				Cane and silver bluestems-----	5
				Scribner panicum----------	5
				Post oak----------	5
				Blackjack oak----------	5
				Lindheimer hackberry----------	5
				Perennial forbs----------	10
6:*					
Bluegrove----------	Tight Sandy Loam----------	Favorable	3,500	Sideoats grama----------	25
		Normal	2,700	Little bluestem----------	15
		Unfavorable	2,000	Arizona cottontop----------	10
				Vine-mesquite----------	10
				Blue grama----------	5
				Silver bluestem----------	5
				Buffalograss----------	5
				Texas needlegrass----------	5
				Purple and Wright threeawns---	5
				Perennial forbs----------	5
Stoneburg----------	Loamy Prairie----------	Favorable	6,000	Little bluestem----------	40
		Normal	4,300	Indiangrass----------	15
		Unfavorable	2,500	Sand bluestem----------	15
				Sideoats grama----------	10
				Switchgrass----------	5
				Sand lovegrass----------	5
				Perennial grasses----------	5
				Perennial forbs----------	5
7---------- Bonti	Tight Sandy Loam----------	Favorable	5,000	Little bluestem----------	30
		Normal	4,000	Sand bluestem----------	10
		Unfavorable	2,500	Indiangrass----------	10
				Sideoats grama----------	10
				Silver bluestem----------	5
				Texas needlegrass----------	5
				Arizona cottontop----------	5
				Scribner panicum----------	5
				Post oak----------	5
				Blackjack oak----------	5
				Perennial forbs----------	10
8---------- Chaney	Loamy Sand----------	Favorable	6,000	Little bluestem----------	30
		Normal	4,500	Sand bluestem----------	10
		Unfavorable	2,500	Indiangrass----------	10
				Sideoats grama----------	10
				Post oak----------	5
				Blackjack oak----------	5
				Silver bluestem----------	5
				Scribner panicum----------	5
				Arizona cottontop----------	5
				Texas needlegrass----------	5
				Perennial forbs----------	10

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Map symbol and soil name	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
9---------- Cisco	Sandy Loam----------	Favorable	6,000	Little bluestem----------	30
		Normal	4,500	Sand bluestem----------	10
		Unfavorable	2,500	Indiangrass----------	10
				Sideoats grama----------	10
				Silver bluestem----------	5
				Scribner panicum----------	5
				Texas needlegrass----------	5
				Arizona cottontop----------	5
				Post oak----------	5
				Blackjack oak----------	5
				Perennial forbs----------	10
10:*					
Darnell----------	Sandstone Hills----------	Favorable	3,000	Little bluestem----------	35
		Normal	2,000	Sand bluestem----------	10
		Unfavorable	1,000	Indiangrass----------	10
				Sideoats grama----------	10
				Switchgrass----------	5
				Scribner panicum----------	5
				Sand lovegrass----------	5
				Post oak----------	5
				Blackjack oak----------	5
				Woody species----------	5
				Perennial forbs----------	5
Truce----------	Sandstone Hills----------	Favorable	3,000	Little bluestem----------	35
		Normal	2,700	Sideoats grama----------	10
		Unfavorable	1,500	Indiangrass----------	10
				Sand bluestem----------	10
				Switchgrass----------	5
				Sand lovegrass----------	5
				Post oak----------	5
				Blackjack oak----------	5
				Scribner panicum----------	5
				Woody species----------	5
				Perennial forbs----------	5
11, 12---------- Deandale	Claypan Prairie----------	Favorable	2,700	Vine-mesquite----------	25
		Normal	2,100	Sideoats grama----------	15
		Unfavorable	1,500	Buffalograss----------	10
				Arizona cottontop----------	10
				Blue grama----------	5
				Western wheatgrass----------	5
				Texas needlegrass----------	5
				Silver bluestem----------	5
				White tridens----------	5
				Tall and meadow dropseeds-----	5
				Purple and Wright threeawns---	5
				Perennial forbs----------	5
13, 14---------- Devol	Loamy Sand----------	Favorable	6,000	Sand bluestem----------	30
		Normal	4,500	Indiangrass----------	20
		Unfavorable	3,000	Switchgrass----------	15
				Little bluestem----------	5
				Giant dropseed----------	5
				Perennial grasses----------	15
				Perennial forbs----------	5
				Woody shrubs----------	5
15, 16---------- Devol	Sandy Loam----------	Favorable	6,000	Little bluestem----------	30
		Normal	4,500	Sand bluestem----------	10
		Unfavorable	2,500	Sideoats grama----------	10
				Indiangrass----------	10
				Oaks and hackberry----------	10
				Texas needlegrass----------	5
				Arizona cottontop----------	5
				Cane and silver bluestems-----	5
				Scribner panicum----------	5
				Perennial forbs----------	10

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Map symbol and soil name	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
17---------- Duffau	Loamy Sand----------	Favorable	6,000	Little bluestem----------	30
		Normal	4,500	Sand bluestem----------	10
		Unfavorable	3,200	Indiangrass----------	10
				Sideoats grama----------	10
				Post oak----------	5
				Blackjack oak----------	5
				Silver bluestem----------	5
				Scribner panicum----------	5
				Texas needlegrass----------	5
				Arizona cottontop----------	5
				Perennial forbs----------	10
18, 19, 20, 21, 22- Enterprise	Sandy Loam----------	Favorable	5,000	Little bluestem----------	30
		Normal	4,000	Sand bluestem----------	15
		Unfavorable	3,000	Indiangrass----------	10
				Sideoats grama----------	10
				Oaks and hackberry----------	10
				Silver bluestem----------	5
				Scribner panicum----------	5
				Texas needlegrass----------	5
				Perennial forbs----------	10
23*---------- Gowen	Loamy Bottomland----------	Favorable	8,000	Indiangrass----------	15
		Normal	5,500	Sand bluestem----------	15
		Unfavorable	3,000	Little bluestem----------	15
				Switchgrass----------	10
				Sideoats grama----------	10
				Western wheatgrass----------	10
				Canada wildrye----------	5
				Vine-mesquite----------	5
				Woody species----------	10
				Perennial forbs----------	5
24---------- Grandfield	Loamy Sand----------	Favorable	4,500	Little bluestem----------	30
		Normal	3,200	Sand bluestem----------	10
		Unfavorable	2,200	Indiangrass----------	10
				Sideoats grama----------	10
				Oaks and hackberry----------	10
				Texas needlegrass----------	5
				Cane and silver bluestems-----	5
				Scribner panicum----------	5
				Arizona cottontop----------	5
				Perennial forbs----------	10
25---------- Grandfield	Sandy Loam----------	Favorable	5,000	Little bluestem----------	30
		Normal	3,400	Sand bluestem----------	10
		Unfavorable	2,400	Sideoats grama----------	10
				Indiangrass----------	10
				Oaks and hackberry----------	10
				Texas needlegrass----------	5
				Arizona cottontop----------	5
				Cane and silver bluestems-----	5
				Scribner panicum----------	5
				Perennial forbs----------	10
26---------- Kamay	Claypan Prairie----------	Favorable	2,700	Vine-mesquite----------	25
		Normal	2,100	Sideoats grama----------	15
		Unfavorable	1,500	Buffalograss----------	10
				Arizona cottontop----------	10
				Blue grama----------	5
				Western wheatgrass----------	5
				Texas needlegrass----------	5
				Silver bluestem----------	5
				White tridens----------	5
				Tall and meadow dropseeds-----	5
				Purple and Wright threeawns---	5
				Perennial forbs----------	5

See footnotes at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Map symbol and soil name	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
27---------- Kirkland	Claypan Prairie----------	Favorable	2,700	Vine-mesquite----------	25
		Normal	2,000	Sideoats grama----------	15
		Unfavorable	1,500	Buffalograss----------	10
				Arizona cottontop----------	10
				Blue grama----------	5
				Western wheatgrass----------	5
				Texas needlegrass----------	5
				Silver bluestem----------	5
				White tridens----------	5
				Tall and meadow dropseeds-----	5
				Purple and Wright threeawns---	5
				Perennial forbs----------	5
28:*					
Knoco----------	Shallow Clay----------	Favorable	1,700	Sideoats grama----------	40
		Normal	1,200	Buffalograss----------	10
		Unfavorable	800	Vine-mesquite----------	5
				Hairy grama----------	5
				Silver bluestem----------	5
				Arizona cottontop----------	5
				Purple threeawn----------	5
				Little bluestem----------	5
				Alkali sacaton----------	5
				Woody species----------	5
				Perennial grasses----------	10
Owens----------	Shallow Clay----------	Favorable	2,500	Sideoats grama----------	30
		Normal	2,000	Silver bluestem----------	15
		Unfavorable	1,000	Buffalograss----------	10
				Vine-mesquite----------	10
				Texas needlegrass----------	5
				Arizona cottontop----------	5
				Hairy grama----------	5
				Rough tridens----------	5
29---------- Lincoln	Sandy Bottomland----------	Favorable	3,800	Switchgrass----------	25
		Normal	2,800	Sand bluestem----------	20
		Unfavorable	2,000	Indiangrass----------	15
				Little bluestem----------	10
				Western wheatgrass----------	10
				Canada wildrye----------	5
				Giant dropseed----------	5
				Perennial grasses----------	5
				Perennial forbs----------	5
30, 31---------- Mangum	Draw----------	Favorable	4,000	Sideoats grama----------	20
		Normal	3,000	Vine-mesquite----------	15
		Unfavorable	2,000	Western wheatgrass----------	15
				Meadow dropseed----------	5
				White tridens----------	5
				Buffalograss----------	5
				Arizona cottontop----------	5
				Blue grama----------	5
				Alkali sacaton----------	5
				Texas needlegrass----------	5
				Silver and cane bluestems-----	5
				Woody species----------	5
				Perennial forbs----------	5
32---------- Mangum	Clayey Bottomland----------	Favorable	3,000	Buffalograss----------	20
		Normal	2,250	Blue grama----------	15
		Unfavorable	1,500	Arizona cottontop----------	10
				Sideoats grama----------	10
				Vine-mesquite----------	10
				Alkali sacaton----------	5
				Western wheatgrass----------	5
				White tridens----------	5
				Silver bluestem----------	5
				Texas needlegrass----------	5
				Woody species----------	5
				Perennial forbs----------	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Map symbol and soil name	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
33, 34, 35, 36, Minco	Loamy Prairie	Favorable	5,000	Little bluestem	40
		Normal	3,700	Sand bluestem	15
		Unfavorable	2,500	Indiangrass	15
				Sideoats grama	10
				Switchgrass	5
				Sand lovegrass	5
				Perennial grasses	5
				Perennial forbs	5
37, 38, 39, Motley	Loamy Prairie	Favorable	4,500	Little bluestem	25
		Normal	3,500	Sideoats grama	15
		Unfavorable	2,200	Vine-mesquite	10
				Arizona cottontop	10
				Blue grama	5
				Texas needlegrass	5
				Plains bristlegrass	5
				Western wheatgrass	5
				Perennial grasses	15
				Perennial forbs	5
40:*					
Nebgen	Sandstone Hills	Favorable	3,000	Little bluestem	35
		Normal	2,200	Sideoats grama	10
		Unfavorable	1,500	Indiangrass	10
				Sand bluestem	10
				Sand lovegrass	5
				Switchgrass	5
				Scribner panicum	5
				Post oak	5
				Blackjack oak	5
				Other woody species	5
				Perennial forbs	5
Grandfield	Sandy Loam	Favorable	5,000	Little bluestem	30
		Normal	3,400	Sand bluestem	10
		Unfavorable	2,400	Sideoats grama	10
				Indiangrass	10
				Oaks and hackberry	10
				Texas needlegrass	5
				Arizona cottontop	5
				Cane and silver bluestems	5
				Scribner panicum	5
				Perennial forbs	10
Callahan	Claypan Prairie	Favorable	4,000	Sideoats grama	30
		Normal	3,500	Little bluestem	15
		Unfavorable	3,000	Arizona cottontop	15
				Vine-mesquite	10
				Texas needlegrass	5
				Buffalograss	5
				Silver bluestem	5
				Blue grama	5
				Purple and Wright threeawns	5
				Perennial forbs	5
41:*					
Nebgen	Sandstone Hills	Favorable	3,000	Little bluestem	35
		Normal	2,400	Sideoats grama	10
		Unfavorable	1,500	Indiangrass	10
				Sand bluestem	10
				Sand lovegrasses	5
				Post oak	5
				Blackjack oak	5
				Switchgrass	5
				Scribner panicum	5
				Other woody species	5
				Perennial forbs	5

See footnote at end table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Map symbol and soil name	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
41:*					
Owens	Rocky Hills	Favorable	1,700	Sideoats grama	40
		Normal	1,200	Silver bluestem	10
		Unfavorable	900	Buffalograss	10
				Vine-mesquite	5
				Arizona cottontop	5
				Hairy grama	5
				Purple threeawn	5
				Little bluestem	5
				Alkali sacaton	5
				Woody species	5
				Perennial forbs	5
42	Draw	Favorable	4,500	Sideoats grama	20
Nipsum		Normal	3,300	Western wheatgrass	15
		Unfavorable	2,000	Vine-mesquite	15
				Texas needlegrass	10
				Blue grama	5
				Buffalograss	5
				Arizona cottontop	5
				Silver bluestem	5
				Meadow dropseed	5
				White tridens	5
				Woody species	5
				Perennial forbs	5
43, 44*	Loamy Bottomland	Favorable	8,000	Sand bluestem	15
Port		Normal	5,500	Indiangrass	15
		Unfavorable	3,000	Switchgrass	10
				Sideoats grama	10
				Western wheatgrass	10
				Woody wheatgrass	10
				Little bluestem	5
				Canada wildrye	5
				Vine-mesquite	5
				Perennial grasses	5
				Perennial forbs	10
45:*					
Renfrow	Claypan Prairie	Favorable	3,600	Vine-mesquite	25
		Normal	2,500	Sideoats grama	15
		Unfavorable	1,800	Buffalograss	10
				Arizona cottontop	10
				Blue grama	5
				Western wheatgrass	5
				Texas needlegrass	5
				Silver bluestem	5
				White tridens	5
				Tall and meadow dropseeds	5
				Purple and Wright threeawns	5
				Perennial forbs	5
Kirkland	Claypan Prairie	Favorable	3,600	Vine-mesquite	25
		Normal	2,500	Sideoats grama	15
		Unfavorable	1,800	Buffalograss	10
				Arizona cottontop	10
				Blue grama	5
				Western wheatgrass	5
				Texas needlegrass	5
				Silver bluestem	5
				White tridens	5
				Tall and meadow dropseeds	5
				Purple and Wright threeawns	5
				Perennial forbs	5

See footnote at end table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Map symbol and soil name	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
45:*					
Anocon	Loamy Prairie	Favorable	6,000	Little bluestem	40
		Normal	4,300	Indiangrass	15
		Unfavorable	2,500	Sand bluestem	15
				Sideoats grama	10
				Switchgrass	5
				Sand lovegrass	5
				Perennial grasses	5
				Perennial forbs	5
46:*					
Renfrow	Claypan Prairie	Favorable	3,600	Vine-mesquite	25
		Normal	2,500	Sideoats grama	15
		Unfavorable	1,800	Buffalograss	10
				Arizona cottontop	10
				Blue grama	5
				Western wheatgrass	5
				Texas needlegrass	5
				Silver bluestem	5
				White tridens	5
				Tall and meadow dropseeds	5
				Purple and Wright threeawns	5
				Perennial forbs	5
Waurika	Claypan Prairie	Favorable	3,500	Vine-mesquite	25
		Normal	2,300	Sideoats grama	15
		Unfavorable	1,500	Buffalograss	10
				Arizona cottontop	10
				Blue grama	5
				Western wheatgrass	5
				Texas needlegrass	5
				Silver bluestem	5
				White tridens	5
				Tall and meadow dropseeds	5
				Purple and Wright threeawns	5
				Perennial forbs	5
47	Clayey Bottomland	Favorable	2,500	Buffalograss	20
Ships		Normal	1,700	Blue grama	15
		Unfavorable	900	Vine-mesquite	10
				Sideoats grama	10
				Arizona cottontop	10
				White tridens	5
				Western wheatgrass	5
				Silver bluestem	5
				Post oak	5
				Blackjack oak	5
				Texas needlegrass	5
				Perennial forbs	5
48	Loamy Sand	Favorable	6,000	Little bluestem	30
Stephenville		Normal	4,500	Sand bluestem	10
		Unfavorable	2,500	Indiangrass	10
				Sideoats grama	10
				Scribner panicum	5
				Post oak	5
				Blackjack oak	5
				Silver bluestem	5
				Texas needlegrass	5
				Arizona cottontop	5
				Perennial forbs	10
49:*					
Stoneburg	Loamy Prairie	Favorable	6,000	Little bluestem	40
		Normal	4,300	Indiangrass	15
		Unfavorable	2,500	Sand bluestem	15
				Sideoats grama	10
				Switchgrass	10
				Perennial grasses	5
				Perennial forbs	5

See footnote at end table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Map symbol and soil name	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
49:*					
Bluegrove	Tight Sandy Loam	Favorable	3,500	Sideoats grama	25
		Normal	2,700	Little bluestem	15
		Unfavorable	2,000	Arizona cottontop	10
				Vine-mesquite	10
				Blue grama	10
				Silver bluestem	10
				Buffalograss	5
				Texas needlegrass	5
				Purple and Wright threeawns	5
				Perennial forbs	5
50	Loamy Prairie	Favorable	6,000	Little bluestem	40
Teller		Normal	4,200	Sand bluestem	15
		Unfavorable	3,000	Indiangrass	15
				Sideoats grama	10
				Switchgrass	5
				Sand lovegrass	5
				Perennial grasses	5
				Perennial forbs	5
51	Sand Hills	Favorable	2,500	Sand bluestem	25
Tivoli		Normal	1,800	Switchgrass	15
		Unfavorable	1,200	Indiangrass	15
				Giant dropseed	10
				Texas bluegrass	10
				Little bluestem	5
				Big sandreed	5
				Sand lovegrass	5
				Scribner panicum	5
				Perennial forbs	5
52	Clay Flat	Favorable	2,000	Buffalograss	30
Treadway		Normal	1,500	Vine-mesquite	10
		Unfavorable	1,000	Blue grama	10
				Alkali sacaton	5
				Western wheatgrass	5
				Sideoats grama	5
				White tridens	5
				Silver bluestem	5
				Tall dropseed	5
				Purple and Wright threeawns	5
				Arizona cottontop	5
				White tridens	5
				Perennial forbs	5
53	Shallow Clay	Favorable	2,200	Sideoats grama	40
Vernon		Normal	1,500	Buffalograss	15
		Unfavorable	1,000	Vine-mesquite	5
				Hairy grama	5
				Silver bluestem	5
				Arizona cottontop	5
				Purple and Wright threeawns	5
				Little bluestem	5
				Alkali sacaton	5
				Woody species	5
				Perennial forbs	5
54	Loamy Bottomland	Favorable	6,000	Indiangrass	15
Weswood		Normal	5,000	Sand bluestem	15
		Unfavorable	4,000	Switchgrass	10
				Sideoats grama	10
				Western wheatgrass	10
				Little bluestem	5
				Canada wildrye	5
				Vine-mesquite	5
				Arizona cottontop	5
				Woody species	10
				Perennial forbs	10

See footnote at end table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Map symbol and soil name	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
55---------- Weswood Variant	Wet Bottomland----------	Favorable	4,000	Inland saltgrass----------	30
		Normal	3,000	Alkali sacaton----------	20
		Unfavorable	2,000	Switchgrass----------	15
				Silver bluestem----------	5
				Vine-mesquite----------	5
				Western wheatgrass----------	5
56:*					
Windthorst--------	Sandy Loam----------	Favorable	6,000	Little bluestem----------	30
		Normal	4,000	Sand bluestem----------	10
		Unfavorable	2,500	Indiangrass----------	10
				Sideoats grama----------	10
				Silver bluestem----------	5
				Scribner panicum----------	5
				Texas needlegrass----------	5
				Arizona cottontop----------	5
				Post oak----------	5
				Blackjack oak----------	5
				Perennial forbs----------	10
Truce----------	Tight Sandy Loam----------	Favorable	4,000	Sideoats grama----------	30
		Normal	3,000	Arizona cottontop----------	15
		Unfavorable	2,000	Vine-mesquite----------	15
				Little bluestem----------	5
				Silver bluestem----------	5
				Buffalograss----------	5
				Texas needlegrass----------	5
57---------- Winters	Clay Loam----------	Favorable	3,000	Sideoats grama----------	20
		Normal	2,600	Vine-mesquite----------	20
		Unfavorable	1,400	Buffalograss----------	15
				Blue grama----------	15
				Arizona cottontop----------	10
				Western wheatgrass----------	10
				Texas needlegrass----------	5
				Silver bluestem----------	5
58, 59*---------- Yomont	Loamy Bottomland----------	Favorable	6,000	Sand bluestem----------	15
		Normal	4,000	Indiangrass----------	15
		Unfavorable	2,500	Sideoats grama----------	10
				Western wheatgrass----------	10
				Switchgrass----------	10
				Little bluestem----------	10
				Vine-mesquite----------	5
				Plains bristlegrass----------	5
				Woody species----------	10
				Perennial forbs----------	10

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails
1 Altus	Slight	Slight	Slight	Slight.
2 Bastrop	Slight	Slight	Slight	Slight.
3, 4 Bastrop	Slight	Slight	Moderate: slope.	Slight.
5 Bastrop	Slight	Slight	Severe: slope.	Slight.
6:* Bluegrove	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
Stoneburg	Slight	Slight	Moderate: slope.	Slight.
7 Bonti	Moderate: percs slowly.	Slight	Moderate: depth to rock, slope.	Slight.
8 Chaney	Moderate: percs slowly.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
9 Cisco	Slight	Slight	Moderate: slope.	Slight.
10:* Darnell	Moderate: large stones.	Moderate: large stones.	Severe: depth to rock, slope.	Moderate: large stones.
Truce	Moderate: large stones, percs slowly.	Moderate: large stones.	Severe: large stones.	Moderate: large stones.
11, 12 Deandale	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
13 Devol	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
14 Devol	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
15 Devol	Slight	Slight	Slight	Slight.
16 Devol	Slight	Slight	Moderate: slope.	Slight.
17 Duffau	Moderate: too sandy.	Moderate: too sandy.	Severe: soil blowing.	Moderate: too sandy.
18 Enterprise	Slight	Slight	Slight	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails
19, 20---------- Enterprise	Slight----------	Slight----------	Moderate: slope.	Slight.
21---------- Enterprise	Slight----------	Slight----------	Severe: slope.	Slight.
22---------- Enterprise	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
23*---------- Gowen	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: too clayey, floods.
24---------- Grandfield	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
25---------- Grandfield	Slight----------	Slight----------	Moderate: slope.	Slight.
26---------- Kamay	Severe: percs slowly.	Slight----------	Severe: percs slowly.	Slight.
27---------- Kirkland	Severe: percs slowly.	Slight----------	Severe: percs slowly.	Slight.
28:* Knoco----------	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
Owens----------	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: slope, too clayey	Severe: too clayey.
29---------- Lincoln	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
30---------- Mangum	Severe: floods, percs slowly.	Moderate. too clayey.	Severe: percs slowly.	Moderate: too clayey.
31---------- Mangum	Severe: floods, percs slowly.	Severe: too clayey.	Severe: percs slowly.	Severe: too clayey.
32---------- Mangum	Severe: floods, percs slowly.	Severe: too clayey.	Severe: percs slowly, floods.	Severe: too clayey.
33---------- Minco	Slight----------	Slight----------	Slight----------	Slight.
34, 35---------- Minco	Slight----------	Slight----------	Moderate: slope.	Slight.
36---------- Minco	Slight----------	Slight----------	Severe: slope.	Slight.
37---------- Motley	Slight----------	Slight----------	Slight----------	Slight.
38, 39---------- Motley	Slight----------	Slight----------	Moderate: slope.	Slight.
40:* Nebgen----------	Severe: depth to rock.	Moderate: large stones.	Severe: depth to rock, slope.	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails
40:*				
Grandfield	Slight	Slight	Severe: slope.	Slight.
Callahan	Severe: percs slowly.	Slight	Severe: slope, percs slowly.	Slight.
41:*				
Nebgen	Severe: depth to rock.	Moderate: large stones.	Severe: depth to rock, slope.	Moderate: large stones.
Owens	Severe: slope, too clayey.	Severe: slope, too clayey.	Severe: slope, too clayey.	Severe: too clayey, slope.
42 Nipsum	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
43 Port	Severe: floods.	Slight	Moderate: floods.	Slight.
44* Port	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
45*:				
Renfrow	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
Kirkland	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
Anocon	Slight	Slight	Slight	Slight.
46:*				
Renfrow	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
Waurika	Severe: wetness, percs slowly.	Moderate: wetness.	Severe: wetness, percs slowly.	Moderate: wetness.
47 Ships	Severe: floods, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
48 Stephenville	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
49:*				
Stoneburg	Slight	Slight	Moderate: slope.	Slight.
Bluegrove	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
50 Teller	Slight	Slight	Slight	Slight.
51 Tivoli	Severe: too sandy, dusty.	Severe: too sandy, dusty.	Severe: too sandy, dusty.	Severe: too sandy, dusty.
52 Treadway	Severe: floods, percs slowly.	Severe: too clayey.	Severe: percs slowly.	Severe: too clayey.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails
53---------- Vernon	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Severe: too clayey.	Moderate: too clayey.
54---------- Weswood	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
55---------- Weswood Variant	Severe: floods.	Moderate: too clayey.	Moderate: floods, too clayey.	Moderate: too clayey.
56:*				
Windthorst----------	Moderate: percs slowly.	Slight----------	Moderate: percs slowly.	Slight.
Truce----------	Moderate: percs slowly.	Slight----------	Moderate: percs slowly, slope.	Slight.
57---------- Winters	Moderate: percs slowly.	Slight----------	Moderate: percs slowly.	Slight.
58---------- Yomont	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
59*---------- Yomont	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
1---------- Altus	Good	Good	Good	Good	Poor	Poor	Good	Very poor	Good.
2, 3---------- Bastrop	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
4, 5---------- Bastrop	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
6:*									
Bluegrove----------	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
Stoneburg----------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
7---------- Bonti	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
8---------- Chaney	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
9---------- Cisco	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
10:*									
Darnell----------	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Truce----------	Poor	Poor	Good	Good	Very poor	Very poor	Poor	Very poor	Good.
11, 12---------- Deandale	Good	Good	Poor	Poor	Poor	Poor	Fair	Very poor	Poor.
13, 14---------- Devol	Fair	Fair	Good	Fair	Poor	Very poor	Fair	Very poor	Fair.
15, 16---------- Devol	Good	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
17---------- Duffau	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
18, 19, 20--------- Enterprise	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
21---------- Enterprise	Fair	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
22---------- Enterprise	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Very poor	Good.
23*---------- Gowen	Very poor	Poor	Fair	Good	Poor	Poor	Poor	Very poor	Fair.
24---------- Grandfield	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
25---------- Grandfield	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
26---------- Kamay	Good	Good	Fair	Fair	Poor	Poor	Good	Very poor	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
27---Kirkland	Good	Good	Good	Fair	Poor	Poor	Good	Very poor	Fair.
28:*									
Knoco	Very poor	Very poor	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
Owens	Poor	Fair	Fair	Poor	Very poor	Very poor	Fair	Very poor	Poor.
29---Lincoln	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
30---Mangum	Good	Good	Fair	Fair	Poor	Poor	Good	Poor	Fair.
31---Mangum	Fair	Fair	Poor	Fair	Poor	Poor	Fair	Poor	Poor.
32---Mangum	Poor	Fair	Poor	Fair	Fair	Fair	Poor	Poor	Poor.
33, 34, 35---Minco	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
36---Minco	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
37, 38, 39---Motley	Good	Good	Fair	Fair	Very poor	Very poor	Good	Very poor	Fair.
40:*									
Nebgen	Very poor	Very poor	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
Grandfield	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
Callahan	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
41:*									
Nebgen	Very poor	Very poor	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
Owens	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor.
42---Nipsum	Good	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
43---Port	Good	Good	Fair	Good	Poor	Poor	Good	Very poor	Fair.
44*---Port	Fair	Good	Good	Good	Poor	Poor	Good	Very poor	Fair.
45:*									
Renfrow	Good	Good	Good	Fair	Poor	Poor	Good	Very poor	Fair.
Kirkland	Good	Good	Good	Fair	Poor	Poor	Good	Very poor	Fair.
Anocon	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
46:*									
Renfrow	Good	Good	Good	Fair	Poor	Poor	Good	Very poor	Fair.
Waurika	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
47---------- Ships	Good	Good	Fair	Fair	Poor	Poor	Good	Poor	Fair.
48---------- Stephenville	Fair	Fair	Good	Good	Poor	Very poor	Fair	Very poor	Good.
49:*									
Stoneburg----------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Bluegrove----------	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
50---------- Teller	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
51---------- Tivoli	Poor	Poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor.
52---------- Treadway	Poor	Poor	Poor	Poor	Poor	Very poor	Poor	Very poor	Poor.
53---------- Vernon	Fair	Fair	Poor	Fair	Poor	Very poor	Fair	Very poor	Fair.
54---------- Weswood	Good	Good	Fair	Good	Poor	Very poor	Good	Very poor	Fair.
55---------- Weswood Variant	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor.
56:*									
Windthorst--------	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
Truce----------	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
57---------- Winters	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
58---------- Yomont	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
59*---------- Yomont	Very poor	Poor	Fair	Good	Poor	Very poor	Poor	Very poor	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
1---------- Altus	Moderate: wetness.	Slight----------	Moderate: wetness.	Slight----------	Moderate: low strength.
2, 3---------- Bastrop	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: low strength.
4, 5---------- Bastrop	Slight----------	Slight----------	Slight----------	Moderate: slope.	Moderate: low strength.
6:*					
Bluegrove--------	Moderate: depth to rock, too clayey.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: low strength, shrink-swell.
Stoneburg--------	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
7---------- Bonti	Severe: depth to rock.	Moderate: depth to rock, shrink-swell.	Severe: depth to rock.	Moderate: depth to rock.	Severe: low strength.
8---------- Chaney	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
9---------- Cisco	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength.
10:*					
Darnell----------	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock, slope.	Moderate: depth to rock, low strength.
Truce----------	Severe: too clayey, large stones.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
11, 12---------- Deandale	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
13---------- Devol	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Moderate: low strength.
14---------- Devol	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Moderate: low strength.
15, 16---------- Devol	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: low strength.
17---------- Duffau	Slight----------	Slight----------	Slight----------	Moderate: slope.	Moderate: low strength.
18, 19, 20-------- Enterprise	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: low strength.
21---------- Enterprise	Slight----------	Slight----------	Slight----------	Moderate: slope.	Moderate: low strength.
22---------- Enterprise	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: slope.
23*---------- Gowen	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
24, 25---------- Grandfield	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: low strength.
26---------- Kamay	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
27---------- Kirkland	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
28:*					
Knoco----------	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Owens----------	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
29---------- Lincoln	Severe: cutbanks cave, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
30, 31, 32-------- Mangum	Severe: floods, too clayey.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.
33, 34---------- Minco	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: low strength.
35, 36---------- Minco	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: low strength.
37, 38, 39-------- Motley	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: low strength.
40:*					
Nebgen----------	Moderate: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.
Grandfield-------	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: low strength.
Callahan---------	Severe: too clayey, depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell, depth to rock.	Moderate: shrink-swell.	Severe: low strength.
41:*					
Nebgen----------	Moderate: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.
Owens----------	Severe: too clayey, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.
42---------- Nipsum	Severe: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
43---------- Port	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: low strength, shrink-swell, floods.
44*---------- Port	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
45:*					
Renfrow----------	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
45:*					
Kirkland	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Anocon	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
46:*					
Renfrow	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Waurika	Severe: wetness, too clayey.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, shrink-swell.
47--- Ships	Severe: too clayey, floods.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: shrink-swell, floods.
48--- Stephenville	Moderate: depth to rock.	Slight---	Moderate: depth to rock.	Slight---	Moderate: low strength.
49:*					
Stoneburg	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
Bluegrove	Moderate: depth to rock, too clayey.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: low strength, shrink-swell.
50--- Teller	Slight---	Slight---	Slight---	Slight---	Moderate: low strength.
51--- Tivoli	Severe: cutbanks cave, too sandy.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
52--- Treadway	Severe: too clayey.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: shrink-swell, low strength.
53--- Vernon	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
54--- Weswood	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: low strength.
55--- Weswood Variant	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: low strength.
56:*					
Windthorst	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Truce	Severe: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
57--- Winters	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
58--- Yomont	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
59*---------- Yomont	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1---------- Altus	Severe: wetness.	Moderate: seepage, wetness.	Moderate: wetness.	Slight----------	Good.
2---------- Bastrop	Moderate: percs slowly.	Moderate: seepage.	Slight----------	Slight----------	Good.
3, 4, 5---------- Bastrop	Moderate: percs slowly.	Moderate: seepage, slope.	Slight----------	Slight----------	Good.
6:*					
Bluegrove----------	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight----------	Fair: too clayey.
Stoneburg----------	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Slight----------	Fair: thin layer.
7---------- Bonti	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight----------	Fair: depth to rock.
8---------- Chaney	Severe: percs slowly.	Slight----------	Moderate: too clayey.	Slight----------	Poor: thin layer.
9---------- Cisco	Slight----------	Moderate: seepage, slope.	Severe: seepage.	Slight----------	Good.
10:*					
Darnell----------	Severe: depth to rock.	Severe: depth to rock, seepage, slope.	Severe: seepage, depth to rock.	Severe: seepage, depth to rock.	Poor: thin layer.
Truce----------	Severe: percs slowly.	Moderate: large stones, slope.	Severe: too clayey, large stones.	Slight----------	Poor: thin layer, large stones.
11---------- Deandale	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Fair: too clayey.
12---------- Deandale	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Fair: too clayey.
13, 14---------- Devol	Slight----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
15, 16---------- Devol	Slight----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
17---------- Duffau	Slight----------	Moderate: seepage, slope.	Slight----------	Slight----------	Good.
18, 19, 20, 21------ Enterprise	Slight----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
22---------- Enterprise	Moderate: slope.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: slope.
23*---------- Gowen	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
24, 25--- Grandfield	Slight	Moderate: seepage.	Slight	Slight	Good.
26--- Kamay	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Fair: too clayey.
27--- Kirkland	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: thin layer, too clayey.
28:*					
Knoco---	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: too clayey.	Slight	Poor: too clayey.
Owens---	Severe: percs slowly, depth to rock.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey, area reclaim.
29--- Lincoln	Severe: floods.	Severe: seepage, floods.	Severe: floods, seepage, too sandy.	Severe: floods, seepage.	Poor: thin layer.
30, 31, 32--- Mangum	Severe: floods, percs slowly.	Severe: floods.	Severe: floods.	Severe: floods.	Poor: too clayey.
33--- Minco	Slight	Moderate: seepage.	Slight	Slight	Good.
34, 35, 36--- Minco	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
37--- Motley	Slight	Moderate: seepage.	Slight	Slight	Good.
38, 39--- Motley	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
40:*					
Nebgen---	Severe: depth to rock.	Severe: depth to rock, slope.	Moderate: depth to rock.	Slight	Poor: thin layer.
Grandfield---	Slight	Moderate: seepage.	Slight	Slight	Good.
Callahan---	Severe: percs slowly.	Moderate: slope.	Severe: too clayey, depth to rock.	Slight	Poor: thin layer.
41:*					
Nebgen---	Severe: depth to rock.	Severe: depth to rock, slope.	Moderate: depth to rock.	Slight	Poor: thin layer.
Owens---	Severe: percs slowly, slope, depth to rock.	Severe: slope.	Severe: too clayey, slope.	Severe: slope.	Poor: too clayey, area reclaim.
42--- Nipsum	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: too clayey.	Poor: too clayey.
43--- Port	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
44*--Port	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
45:*					
Renfrow	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: thin layer.
Kirkland	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: thin layer, too clayey.
Anocon	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
46:*					
Renfrow	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: thin layer.
Waurika	Severe: percs slowly, wetness.	Slight	Severe: too clayey.	Severe: wetness.	Poor: thin layer.
47--Ships	Severe: percs slowly, floods.	Severe: floods.	Severe: too clayey, floods.	Severe: floods.	Poor: too clayey.
48--Stephenville	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: thin layer, too sandy.
49:*					
Stoneburg	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Slight	Fair: thin layer.
Bluegrove	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Fair: too clayey.
50--Teller	Slight	Severe: seepage.	Severe: seepage.	Slight	Good.
51--Tivoli	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
52--Treadway	Severe: percs slowly.	Severe: floods.	Severe: too clayey.	Moderate: floods.	Poor: hard to pack, too clayey.
53--Vernon	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
54--Weswood	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
55--Weswood Variant	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
56:*					
Windthorst	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Truce	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: thin layer.
57--Winters	Moderate: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
58---------- Yomont	Severe: floods.	Severe: floods, seepage.	Severe: seepage, floods.	Severe: seepage, floods.	Good.
59*---------- Yomont	Severe: floods.	Severe: floods, seepage.	Severe: seepage, floods.	Severe: seepage, floods.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1---------- Altus	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
2, 3, 4, 5---------- Bastrop	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
6:*				
Bluegrove----------	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Stoneburg----------	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
7---------- Bonti	Poor: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
8---------- Chaney	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
9---------- Cisco	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
10:*				
Darnell----------	Fair: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Truce----------	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
11, 12---------- Deandale	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
13, 14---------- Devol	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
15, 16---------- Devol	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
17---------- Duffau	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
18, 19, 20, 21-------- Enterprise	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
22---------- Enterprise	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
23*---------- Gowen	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
24---------- Grandfield	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
25---------- Grandfield	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
26---------- Kamay	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
27--Kirkland	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
28:*				
Knoco	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Owens	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
29--Lincoln	Good	Fair: excess fines.	Unsuited: excess fines.	Fair: thin layer.
30, 31, 32--Mangum	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
33, 34, 35, 36--Minco	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
37, 38, 39--Motley	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
40:*				
Nebgen	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
Grandfield	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Callahan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
41:*				
Nebgen	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
Owens	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
42--Nipsum	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
43--Port	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
44*--Port	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
45*:				
Renfrow	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Kirkland	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Anocon	Fair: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
46:*				
Renfrow	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Waurika	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
47--- Ships	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
48--- Stephenville	Fair: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor. too sandy.
49:*				
Stoneburg	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Bluegrove	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
50--- Teller	Good---	Unsuited: excess fines.	Unsuited: excess fines.	Good.
51--- Tivoli	Good---	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
52--- Treadway	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
53--- Vernon	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
54--- Weswood	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
55--- Weswood Variant	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess salt.
56:*				
Windthorst	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Truce	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
57--- Winters	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
58, 59*--- Yomont	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Map symbol and soil name	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Irrigation	Terraces and diversions	Grassed waterways
1---------- Altus	Moderate: seepage.	Moderate: unstable fill, piping, compressible.	Moderate: slow refill.	Favorable------	Favorable------	Favorable.
2, 3, 4, 5-------- Bastrop	Moderate: seepage.	Slight----------	Severe: no water.	Fast intake, soil blowing, slope.	Soil blowing---	Erodes easily.
6:*						
Bluegrove--------	Severe: depth to rock.	Moderate: thin layer.	Severe: no water.	Rooting depth, percs slowly.	Complex slope, depth to rock.	Percs slowly, rooting depth.
Stoneburg--------	Severe: depth to rock.	Moderate: thin layer.	Severe: no water.	Rooting depth, erodes easily.	Depth to rock--	Percs slowly, rooting depth.
7---------- Bonti	Severe: depth to rock.	Moderate: thin layer.	Severe: no water.	Slow intake----	Depth to rock--	Percs slowly, rooting depth.
8---------- Chaney	Slight----------	Moderate: erodes easily.	Severe: no water.	Percs slowly, soil blowing.	Piping, erodes easily.	Erodes easily.
9---------- Cisco	Moderate: seepage.	Moderate: erodes easily.	Severe: no water.	Erodes easily	Erodes easily	Erodes easily.
10:*						
Darnell----------	Severe: seepage.	Severe: thin layer.	Severe: no water.	Slope, rooting depth.	Depth to rock	Rooting depth, depth to rock.
Truce----------	Slight----------	Severe: large stones.	Severe: no water.	Slow intake, complex slope.	Slope, large stones.	Slope, large stones.
11, 12---------- Deandale	Slight----------	Moderate: shrink-swell.	Severe: no water.	Slow intake----	Percs slowly---	Percs slowly.
13, 14, 15, 16---- Devol	Severe: seepage.	Severe: piping.	Severe: no water.	Fast intake, soil blowing, slope.	Soil blowing---	Favorable.
17---------- Duffau	Moderate: seepage.	Moderate: erodes easily, piping.	Severe: no water.	Soil blowing, erodes easily.	Soil blowing, erodes easily.	Erodes easily.
18, 19, 20, 21---- Enterprise	Severe: seepage.	Moderate: piping, unstable fill.	Severe: no water.	Fast intake----	Erodes easily	Favorable.
22---------- Enterprise	Severe: seepage.	Moderate: piping, unstable fill.	Severe: no water.	Slope----------	Slope, erodes easily.	Slope, erodes easily.
23*---------- Gowen	Moderate: seepage.	Moderate: compressible.	Severe: no water.	Floods---------	Wetness--------	Favorable.
24, 25---------- Grandfield	Moderate: seepage.	Moderate: unstable fill, piping, compressible.	Severe: no water.	Favorable------	Favorable------	Favorable.
26---------- Kamay	Slight----------	Moderate: unstable fill, shrink-swell.	Severe: no water.	Slow intake, percs slowly.	Percs slowly---	Percs slowly.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Irrigation	Terraces and diversions	Grassed waterways
27---- Kirkland	Slight----	Severe: compressible, piping.	Severe: no water.	Slow intake----	Percs slowly, piping.	Percs slowly.
28:*						
Knoco----	Slight----	Moderate: shrink-swell.	Severe: no water.	Not needed----	Not needed----	Not needed.
Owens----	Slight----	Moderate: compressible, large stones.	Severe: no water.	Droughty, percs slowly, large stones.	Slope, rooting depth, large stones.	Droughty, erodes easily, large stones.
29---- Lincoln	Severe: seepage.	Severe: seepage.	Severe: no water.	Floods, droughty.	Not needed----	Not needed.
30, 31, 32---- Mangum	Slight----	Moderate: hard to pack.	Severe: no water.	Floods, slow intake.	Not needed----	Not needed.
33---- Minco	Moderate: seepage.	Moderate: unstable fill, compressible, piping.	Severe: no water.	Favorable----	Favorable----	Favorable.
34, 35, 36---- Minco	Moderate: seepage.	Moderate: unstable fill, compressible, piping.	Severe: no water.	Erodes easily	Erodes easily	Erodes easily.
37---- Motley	Moderate: seepage.	Moderate: piping, seepage.	Severe: no water.	Favorable----	Favorable----	Favorable.
38, 39---- Motley	Moderate: seepage.	Moderate: piping, seepage.	Severe: no water.	Slope----	Favorable----	Favorable.
40:*						
Nebgen----	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Droughty, rooting depth, large stones.	Rooting depth, depth to rock, large stones.	Droughty, rooting depth, slope.
Grandfield----	Moderate: seepage.	Moderate: unstable fill, piping, compressible.	Severe: no water.	Favorable----	Favorable----	Favorable.
Callahan----	Severe: depth to rock.	Moderate: compressible.	Severe: no water.	Percs slowly---	Percs slowly---	Percs slowly.
41:*						
Nebgen----	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Droughty, rooting depth, large stones.	Rooting depth, depth to rock, large stones.	Droughty, rooting depth, slope, large stones.
Owens----	Slight----	Moderate: compressible, large stones.	Severe: no water.	Droughty, percs slowly, large stones.	Slope, rooting depth, large stones.	Droughty, erodes easily, large stones.
42---- Nipsum	Slight----	Moderate: compressible, piping.	Severe: no water.	Slow intake----	Favorable----	Favorable.
43, 44*---- Port	Moderate: seepage.	Moderate: piping.	Severe: deep to water.	Erodes easily, floods.	Not needed----	Not needed.
45:*						
Renfrow----	Slight----	Moderate: unstable fill, compressible.	Severe: no water.	Erodes easily, percs slowly.	Erodes easily, percs slowly.	Erodes easily, percs slowly.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Irrigation	Terraces and diversions	Grassed waterways
45:*						
Kirkland	Slight	Severe: compressible, piping.	Severe: no water.	Slow intake	Percs slowly, piping.	Percs slowly.
Anocon	Slight	Slight	Severe: no water.	Complex slope, slow intake.	Favorable	Favorable.
46:*						
Renfrow	Slight	Moderate: unstable fill, compressible.	Severe: no water.	Erodes easily, percs slowly.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Waurika	Slight	Moderate: compressible, unstable fill, shrink-swell.	Severe: slow refill.	Wetness, slow intake.	Not needed	Not needed.
47--- Ships	Slight	Moderate: hard to pack.	Severe: deep to water.	Slow intake, percs slowly.	Percs slowly	Percs slowly.
48--- Stephenville	Severe: depth to rock.	Moderate: thin layer.	Severe: no water.	Erodes easily, fast intake.	Too sandy	Erodes easily, fast intake.
49:*						
Stoneburg	Severe: depth to rock.	Moderate: thin layer.	Severe: no water.	Rooting depth, erodes easily.	Depth to rock	Percs slowly.
Bluegrove	Severe: depth to rock.	Moderate: thin layer.	Severe: no water.	Rooting depth, percs slowly.	Complex slope, depth to rock.	Percs slowly, rooting depth.
50--- Teller	Severe: seepage.	Moderate: unstable fill, piping.	Severe: no water.	Favorable	Favorable	Favorable.
51--- Tivoli	Severe: seepage.	Severe: unstable fill, seepage, piping.	Severe: deep to water.	Complex slope, erodes easily, droughty.	Complex slope, erodes easily, fast intake, too sandy.	Erodes easily, droughty, seepage, too sandy.
52--- Treadway	Slight	Severe: unstable fill.	Severe: deep to water.	Excess salt, slow intake.	Erodes easily, percs slowly.	Droughty, excess salt.
53--- Vernon	Slight	Moderate: hard to pack.	Severe: no water.	Slow intake, percs slowly, droughty.	Favorable	Droughty, percs slowly, slope.
54--- Weswood	Moderate: seepage.	Moderate: piping, erodes easily.	Severe: no water.	Floods	Favorable	Favorable.
55--- Weswood Variant	Moderate: seepage.	Moderate: excess salt.	Severe: no water.	Floods, excess salt.	Not needed	Excess salt.
56:*						
Windthorst	Moderate: seepage.	Moderate: compressible.	Severe: no water.	Percs slowly, erodes easily.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Truce	Slight	Moderate: shrink-swell.	Severe: no water.	Percs slowly	Favorable	Favorable.
57--- Winters	Moderate: seepage.	Moderate: compressible, piping.	Severe: no water.	Slow intake, slope.	Favorable	Percs slowly.
58, 59* Yomont	Severe: seepage.	Moderate: piping, unstable fill, seepage.	Severe: no water.	Floods, fast intake.	Not needed	Not needed.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1---------- Altus	0-12	Fine sandy loam	SM, ML, SC, CL	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	12-50	Fine sandy loam, sandy clay loam.	SM, ML, SC, CL	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16
2, 3, 4, 5---------- Bastrop	0-8	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	95-100	80-100	80-100	36-70	18-25	2-7
	8-80	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	95-100	80-100	80-100	40-70	26-40	11-22
6:*											
Bluegrove----------	0-6	Loam----------	SC, SM-SC, CL, CL-ML	A-4, A-6	0	100	98-100	80-100	45-70	20-30	4-12
	6-30	Clay loam, clay, sandy clay.	CL	A-6, A-7	0-5	95-100	95-100	85-100	51-80	28-50	11-30
	30-48	Weathered bedrock.									
Stoneburg----------	0-12	Loam----------	ML, CL-ML, SM, SC	A-4	0	95-100	95-100	85-100	40-75	17-30	3-10
	12-17	Loam, sandy clay loam.	CL, SC	A-4, A-6	0	95-100	95-100	90-100	40-80	25-35	8-15
	17-28	Clay loam, sandy clay loam.	SC, CL	A-6, A-4	0	95-100	95-100	90-100	45-80	25-40	8-20
	28-38	Clay loam, sandy clay loam.	SC, CL	A-6, A-4	0-15	85-100	85-100	75-98	45-80	25-40	8-20
	38-50	Weathered bedrock.									
7---------- Bonti	0-6	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0-2	90-100	90-100	70-100	25-70	20-30	2-7
	6-36	Clay, clay loam, sandy clay.	CL	A-6, A-7	0-4	80-100	80-100	70-100	51-75	30-45	18-25
	36-40	Weathered bedrock.									
8---------- Chaney	0-15	Loamy fine sand	SM, SM-SC, SP-SM	A-2-4, A-4, A-3	0	80-100	80-100	65-98	7-45	<25	NP-4
	15-45	Clay, sandy clay	CL, CH	A-7-6	0	90-100	90-100	90-100	51-85	42-60	24-42
	45-80	Sandy clay, clay, sandy clay loam.	CL, CH, SC	A-6, A-7-6, A-2-6	0	90-100	90-100	80-100	30-70	25-55	11-40
9---------- Cisco	0-9	Fine sandy loam	SM, SM-SC, CL-ML, ML	A-4	0	95-100	95-100	90-100	40-55	<26	NP-7
	9-50	Sandy clay loam, clay loam.	SC, CL	A-6	0	95-100	95-100	85-100	40-60	25-40	11-25
	50-80	Sandy clay loam, fine sandy loam.	SC, CL	A-4, A-6	0	95-100	95-100	85-95	40-60	20-35	8-20

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
10:*											
Darnell	0-6	Fine sandy loam	SM, SC, ML, CL	A-4	0-5	90-100	90-100	85-100	36-60	<30	NP-10
	6-14	Fine sandy loam, loam.	SM, SC, ML, CL	A-4	0-8	70-100	70-100	60-100	36-60	<30	NP-10
	14-30	Weathered bedrock.									
Truce	0-6	Stony fine sandy loam.	SC, CL-ML, CL, SM-SC	A-4	5-20	70-90	70-85	65-85	36-60	20-30	5-10
	6-45	Clay, sandy clay, clay loam.	CL	A-6, A-7	0-10	80-100	80-100	80-100	50-80	30-45	18-25
	45-60	Weathered bedrock.									
11, 12 Deandale	0-9	Silt loam	CL, ML, CL-ML	A-4, A-6	0	100	100	95-100	60-95	20-40	5-25
	9-80	Clay, clay loam	CL, CH	A-6, A-7-6	0	95-100	95-100	95-100	70-98	35-60	20-40
13, 14 Devol	0-13	Loamy fine sand	SM	A-2	0	98-100	98-100	90-100	15-35	---	NP
	13-55	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0	98-100	98-100	94-100	36-60	<26	NP-7
	55-80	Loamy fine sand, loamy sand, fine sand.	SM	A-2, A-4	0	98-100	98-100	50-100	15-50	<26	NP-3
15, 16 Devol	0-8	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0	98-100	98-100	94-100	36-60	<26	NP-7
	8-80	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0	98-100	98-100	94-100	36-60	<26	NP-7
17 Duffau	0-14	Loamy fine sand	SM, SM-SC	A-2-4, A-4	0	95-100	95-100	75-98	15-40	<22	NP-4
	14-68	Sandy clay loam, clay loam, loam.	SC, CL	A-6	0	95-100	95-100	80-100	36-65	30-40	15-24
	68-80	Sandy clay loam, loam, fine sandy loam.	SC, CL, CL-ML, SM	A-4, A-6	0	95-100	95-100	80-100	40-65	20-36	2-18
18, 19, 20, 21, 22- Enterprise	0-26	Very fine sandy loam.	CL-ML, ML, CL	A-4, A-6	0	100	98-100	90-100	55-90	20-32	3-13
	26-75	Very fine sandy loam, loam, silt loam.	CL-ML, ML, CL	A-4, A-6	0	100	98-100	90-100	55-90	20-32	3-13
23* Gowen	0-15	Loam	CL	A-6, A-7-6	0	100	95-100	85-100	60-85	28-43	11-25
	15-60	Clay loam, loam, sandy clay loam.	CL	A-4, A-6, A-7-6	0	100	95-100	85-100	55-85	25-43	10-25
24 Grandfield	0-10	Loamy fine sand	SM	A-2	0	100	98-100	90-100	15-35	---	NP
	10-80	Fine sandy loam, sandy clay loam.	SM, SC, CL, ML	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16
25 Grandfield	0-7	Fine sandy loam	SM, ML, SC, CL	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	7-80	Fine sandy loam, sandy clay loam.	SM, SC, CL, ML	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
26---------- Kamay	0-9	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	90-100	60-90	20-40	5-20
	9-63	Clay, clay loam	CL, CH	A-6, A-7-6	0	95-100	95-100	90-100	70-98	35-60	18-40
	63-80	Weathered bedrock.									
27---------- Kirkland	0-12	Silt loam-------	CL-ML	A-4, A-6	0	100	100	96-100	80-97	30-37	8-13
	12-34	Silty clay, clay	CL, CH	A-7	0	100	100	96-100	90-99	41-65	18-38
	34-80	Clay, silty clay, clay loam.	CL, CH	A-6, A-7	0	100	100	96-100	80-99	37-65	15-38
28:*											
Knoco----------	0-5	Clay----------	CL, CH	A-7-6, A-6	0-5	90-100	90-100	90-100	80-98	32-60	14-38
	5-16	Weathered bedrock (clayey shale).	CL, CH	A-7-6, A-6	0-5	90-100	85-100	60-100	60-95	30-60	13-38
Owens----------	0-6	Clay----------	CL, CH	A-7-6	0-5	95-100	95-100	85-100	75-95	45-60	22-32
	6-15	Clay, clay loam, silty clay.	CL, CH	A-7-6	0-5	95-100	90-100	85-100	75-95	45-60	22-32
	15-30	Weathered bedrock.									
29---------- Lincoln	0-10	Fine sandy loam	ML, CL, SM, SC	A-4, A-6	0	100	98-100	94-100	36-90	<40	NP-18
	10-60	Stratified fine sand to clay loam.	SM, SP-SM	A-2, A-3	0	100	98-100	82-100	5-35	---	NP
30---------- Mangum	0-10	Silty clay loam	CL, ML	A-6, A-7-6	0	100	100	98-100	85-100	30-45	11-22
	10-60	Clay, silty clay	CL, CH	A-7-6	0	100	100	95-100	80-100	41-70	22-45
31, 32---------- Mangum	0-12	Clay----------	CL, CH	A-7-6	0	100	100	98-100	90-100	41-70	20-45
	12-60	Clay, silty clay	CL, CH	A-7-6	0	100	100	95-100	80-100	41-70	22-45
33----------	0-30	Very fine sandy loam.	ML, CL	A-4	0	100	100	94-100	51-97	<31	NP-10
Minco	30-80	Loam, silt loam, fine sandy loam.	ML, CL, SM, SC	A-4	0	100	98-100	94-100	36-97	<31	NP-10
34, 35, 36--------- Minco	0-30	Very fine sandy loam.	ML, CL	A-4	0	100	100	94-100	51-97	<31	NP-10
	30-80	Loam, silt loam, fine sandy loam.	ML, CL, SM, SC	A-4	0	100	98-100	94-100	36-97	<31	NP-10
37, 38, 39--------- Motley	0-7	Loam----------	CL, CL-ML	A-4, A-6	0	100	98-100	90-100	60-80	20-35	4-15
	7-63	Sandy clay loam, clay loam.	CL	A-6	0	100	98-100	90-100	60-85	25-40	11-23
	63-80	Sandy clay loam, loam.	CL, CL-ML	A-6, A-4	0	90-100	85-100	80-98	55-80	22-35	7-18
40:*											
Nebgen----------	0-6	Stony fine sandy loam.	SC, CL, SM-SC, CL-ML	A-4, A-6	2-25	75-100	75-100	70-85	40-55	20-32	4-13
	6-12	Weathered bedrock.									
Grandfield--------	0-9	Fine sandy loam	SM, ML, SC, CL	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	9-70	Fine sandy loam, sandy clay, loam, loam.	SM, SC, CL, ML	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
40:*											
Callahan	0-10	Loam	CL, CL-ML, SC, SM-SC	A-4, A-6	0	85-100	85-100	75-100	45-80	25-35	7-16
	10-35	Clay, clay loam	CL	A-6, A-7-6	0	90-100	90-100	80-100	60-95	35-50	19-30
	35-60	Shaly clay, weathered bedrock.									
41:*											
Nebgen	0-6	Fine sandy loam	SC, CL, SM-SC, CL-ML	A-4, A-6	2-25	75-100	75-100	70-85	40-55	20-32	4-13
	6-12	Weathered bedrock.									
Owens	0-5	Clay	CL, CH	A-7-6	5-20	90-100	80-100	70-100	60-95	45-60	22-32
	5-14	Clay, clay loam, silty clay.	CL, CH	A-7-6	0-5	95-100	90-100	85-100	75-95	45-60	22-32
	14-30	Weathered bedrock.									
42 Nipsum	0-60	Clay loam	CL	A-7-6	0-2	98-100	90-100	90-100	80-95	41-50	20-30
	60-80	Clay, silty clay, shaly clay.	CL	A-7-6	0	98-100	90-100	90-100	80-100	41-50	20-30
43 Port	0-17	Clay loam	CL	A-4, A-6, A-7	0	100	100	96-100	80-98	27-43	8-20
	17-60	Silty clay loam, clay loam, loam.	CL	A-4, A-6, A-7	0	100	100	96-100	65-98	27-43	8-20
44* Port	0-25	Silt loam	CL	A-4, A-6, A-7	0	100	100	96-100	80-98	27-43	8-20
	25-80	Silty clay loam, clay loam, loam.	CL	A-4, A-6, A-7	0	100	100	96-100	65-98	27-43	8-20
45:*											
Renfrow	0-9	Loam	ML, CL	A-4, A-6	0	100	100	96-100	65-97	30-37	8-14
	9-15	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	96-100	80-98	37-49	15-26
	15-80	Clay, silty clay, silty clay loam.	ML, CL, CH, MH	A-6, A-7	0	100	100	96-100	80-99	37-70	15-38
Kirkland	0-12	Silt loam	CL-ML	A-4, A-6	0	100	100	96-100	80-97	30-37	8-13
	12-34	Silty clay, clay	CL, CH	A-7	0	100	100	96-100	90-99	41-65	18-38
	34-80	Clay, silty clay, clay loam.	CL, CH	A-6, A-7	0	100	100	96-100	80-99	37-65	15-38
Anocon	0-13	Loam	ML, CL-ML, SM, SC	A-4	0	95-100	95-100	85-100	36-70	17-30	3-10
	13-54	Sandy clay, clay, clay loam.	CL, SC	A-6, A-7	0	95-100	95-100	90-100	45-80	30-49	15-30
	54-80	Sandy clay loam, clay loam.	SC, CL	A-6, A-7, A-4	0	90-100	90-100	85-100	40-80	25-45	8-25

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
46:*											
Renfrow	0-9	Loam	ML, CL	A-4, A-6	0	100	100	96-100	65-97	30-37	8-14
	9-13	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	96-100	80-98	37-49	15-26
	13-80	Clay, silty clay, silty clay loam.	ML, CL, CH, MH	A-6, A-7	0	100	100	96-100	80-99	37-70	15-38
Waurika	0-14	Silt loam	CL, ML	A-4, A-6	0	100	100	96-100	80-95	22-37	3-14
	14-39	Clay, silty clay	CL, CH, MH	A-7	0	95-100	95-100	90-100	80-98	41-66	20-40
	39-80	Silty clay loam, clay loam, clay.	CL, CH, ML, MH	A-6, A-7	0	90-100	90-100	85-100	80-98	38-55	16-30
47	0-50	Clay	CH	A-7-6	0	100	100	95-100	95-100	60-75	35-50
Ships	50-60	Clay, silty clay, silty clay loam.	CH	A-7-6	0	100	100	95-100	85-100	51-70	32-50
48	0-15	Loamy fine sand	SM	A-2	0	100	98-100	90-100	15-35	---	NP
Stephenville	15-33	Fine sandy loam, sandy clay loam.	SC, CL	A-4, A-6	0	100	98-100	90-100	36-65	25-37	7-16
	33-48	Weathered bedrock.									
49:*											
Stoneburg	0-12	Loam	ML, CL-ML, SM, SC	A-4	0	95-100	95-100	85-100	40-75	17-30	3-10
	12-17	Loam, sandy clay loam.	CL, SC	A-4, A-6	0	95-100	95-100	90-100	40-80	25-35	8-15
	17-28	Clay loam, sandy clay loam.	SC, CL	A-6, A-4	0	95-100	95-100	90-100	45-80	25-40	8-20
	28-38	Clay loam, sandy clay loam.	SC, CL	A-6, A-4	0-15	85-100	85-100	75-98	45-80	25-40	8-20
	38-50	Weathered bedrock.									
Bluegrove	0-6	Loam	SC, SM-SC, CL, CL-ML	A-4, A-6	0	100	98-100	80-100	45-70	20-30	4-12
	6-30	Clay loam, clay, sandy clay.	CL	A-6, A-7	0-5	95-100	95-100	85-100	51-80	28-50	11-30
	30-48	Weathered bedrock.									
50	0-8	Loam	SM, SC, ML, CL	A-4	0	100	100	94-100	36-85	<30	NP-10
Teller	8-80	Sandy clay loam, clay loam.	SC, CL	A-6, A-4	0	100	100	90-100	45-85	24-40	7-18
51	0-9	Fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	98-100	80-100	5-35	---	NP
Tivoli	9-60	Fine sand, sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	98-100	80-98	5-20	---	NP
52	0-8	Clay	CL, CH	A-6, A-7	0	100	100	96-100	80-98	37-70	15-38
Treadway	8-30	Clay	CH, CL	A-7	0	100	100	96-100	90-95	45-70	19-38
	30-60	Clay	CH, CL	A-7	0	100	100	96-100	90-95	45-70	19-38

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
53---------- Vernon	0-17	Clay----------	CL, CH	A-6, A-7-6	0	95-100	90-100	90-100	80-98	38-60	20-38
	17-32	Clay, silty clay	CL, CH	A-6, A-7-6	0	95-100	90-100	90-100	80-98	38-60	20-38
	32-60	Weathered shale breaks to clay.									
54---------- Weswood	0-8	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	95-100	70-95	20-35	4-15
	8-60	Silt loam, silty clay loam, clay loam.	CL	A-6, A-7	0	100	100	90-100	70-98	30-46	11-26
55---------- Weswood Variant	0-60	Silt loam, silty clay loam.	CL, ML, CL-ML	A-4, A-6	0	100	98-100	95-100	70-98	25-40	7-20
56:* Windthorst--------	0-9	Fine sandy loam	SM, SM-SC, CL-ML	A-4	0	95-100	90-100	75-100	36-75	<28	NP-7
	9-33	Clay, sandy clay, clay loam.	CL, CH	A-6, A-7-6	0	95-100	95-100	85-100	51-90	35-53	20-35
	33-80	Sandy clay loam, clay, fine sandy loam.	SC, CL	A-4 A-6, A-7-6	0	85-100	80-100	75-100	36-90	25-45	8-28
Truce----------	0-6	Fine sandy loam	CL-ML, CL, SM-SC, SC	A-4	0	75-100	75-100	70-100	40-75	20-30	5-10
	6-49	Clay, sandy clay, clay loam.	CL	A-6, A-7	0	80-100	80-100	80-100	50-80	30-45	18-25
	49-60	Weathered bedrock.									
57---------- Winters	0-6	Loam----------	CL	A-4, A-6	0	98-100	95-100	75-95	51-70	24-35	8-15
	6-65	Sandy clay, clay, clay loam.	CL, CH	A-7-6	0	95-100	90-100	80-100	51-75	41-52	20-30
	65-80	Clay loam, sandy clay loam, sandy clay.	CL, CH	A-6, A-7-6	0	95-100	90-100	80-100	51-75	38-52	17-30
58, 59*---------- Yomont	0-60	Very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	98-100	90-100	51-90	<30	NP-12

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Map symbol and soil name	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
							K	T	
	In	In/hr	In/in	pH	Mmhos/cm				
1----------	0-12	2.0-6.0	0.11-0.15	7.9-8.4	<2	Low-------	0.24	5	3
Altus	12-50	0.6-2.0	0.11-0.17	7.9-8.4	<2	Low-------	0.32		
2, 3, 4, 5-------	0-8	2.0-6.0	0.11-0.17	5.6-7.3	<2	Low-------	0.37	5	3
Bastrop	8-80	0.6-2.0	0.15-0.19	5.6-8.4	<2	Low-------	0.32		
6:*									
Bluegrove-------	0-6	0.6-2.0	0.14-0.19	5.6-7.3	<2	Low-------	0.28	2	5
	6-30	0.2-0.6	0.15-0.20	5.6-7.8	<2	Moderate	0.32		
	30-48	---	---	---	---	----------	---		
Stoneburg-------	0-12	2.0-6.0	0.11-0.20	5.6-7.3	<2	Low-------	0.24	2	5
	12-17	0.6-2.0	0.12-0.20	5.6-7.3	<2	Low-------	0.32		
	17-28	0.2-0.6	0.12-0.20	5.6-7.3	<2	Moderate	0.32		
	28-38	0.2-0.6	0.12-0.20	5.6-7.8	<2	Moderate	0.32		
	38-50	---	---	---	---	----------	---		
7----------	0-6	0.6-2.0	0.11-0.15	5.6-7.3	<2	Low-------	0.37	2	3
Bonti	6-36	0.2-0.6	0.15-0.20	5.1-6.0	<2	Moderate	0.32		
	36-40	---	---	---	---	----------	---		
8----------	0-15	2.0-6.0	0.05-0.10	5.6-7.3	<2	Low-------	0.20	5	2
Chaney	15-45	0.06-0.2	0.15-0.18	5.6-7.3	<2	Moderate	0.28		
	45-80	0.06-0.2	0.15-0.18	5.6-6.5	<2	Moderate	0.28		
9----------	0-9	2.0-6.0	0.11-0.15	6.1-7.3	<2	Low-------	0.37	5	3
Cisco	9-50	0.6-2.0	0.15-0.19	6.1-7.8	<2	Moderate	0.32		
	50-80	2.0-6.0	0.11-0.17	7.4-8.4	<2	Low-------	0.32		
10:*									
Darnell----------	0-6	2.0-6.0	0.12-0.16	5.1-7.3	<2	Low-------	0.20	2	3
	6-14	2.0-6.0	0.12-0.16	5.1-7.3	<2	Low-------	0.32		
	14-30	---	---	---	---	----------	---		
Truce----------	0-6	0.6-2.0	0.08-0.12	5.6-7.3	<2	Low-------	0.24	3	3
	6-45	0.06-0.2	0.12-0.18	6.1-8.4	<2	Moderate	0.32		
	45-60	---	---	---	---	----------	---		
11, 12----------	0-9	0.6-2.0	0.15-0.20	6.1-8.4	<4	Low-------	0.43	5	6
Deandale	9-80	<0.06	0.12-0.18	6.6-8.4	<4	High------	0.37		
13, 14----------	0-13	2.0-6.0	0.07-0.11	6.6-7.8	<2	Low-------	0.15	5	2
Devol	13-55	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low-------	0.20		
	55-80	2.0-6.0	0.08-0.12	6.6-8.4	<2	Low-------	0.17		
15, 16----------	0-8	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low-------	0.20	5	3
Devol	8-80	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low-------	0.20		
17----------	0-14	2.0-6.0	0.07-0.11	6.1-7.8	<2	Low-------	0.32	5	2
Duffau	14-68	0.6-2.0	0.12-0.19	6.1-7.8	<2	Low-------	0.32		
	68-80	---	---	---	---	----------	---		
18, 19, 20, 21, 22----------	0-26	2.0-6.0	0.15-0.20	6.6-8.4	<2	Low-------	0.43	5	3
Enterprise	26-75	2.0-6.0	0.15-0.20	7.4-8.4	<2	Low-------	0.43		
23*----------	0-15	0.6-2.0	0.15-0.20	6.6-8.4	<2	Moderate	0.28	5	7
Gowen	15-60	0.6-2.0	0.15-0.20	6.6-8.4	<2	Moderate	0.28		
24----------	0-10	2.0-6.0	0.07-0.11	6.1-7.8	<2	Low-------	0.20	5	2
Grandfield	10-80	0.6-2.0	0.11-0.17	6.1-8.4	<2	Low-------	0.32		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Map symbol and soil name	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
							K	T	
	In	In/hr	In/in	pH	Mmhos/cm				
25----------	0-7	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low-------	0.24	5	3
Grandfield	7-80	0.6-2.0	0.11-0.17	6.1-8.4	<2	Low-------	0.32		
26----------	0-9	0.6-2.0	0.15-0.20	6.1-8.4	<2	Low-------	0.37	5	5
Kamay	9-63	<0.06	0.12-0.18	6.6-8.4	<4	High------	0.37		
	63-80	---	---	---	---	----------	---		
27----------	0-12	0.6-2.0	0.16-0.24	5.6-7.3	<2	Low-------	0.49	5	6
Kirkland	12-34	<0.06	0.12-0.18	6.6-8.4	<2	High------	0.37		
	34-80	0.2-0.6	0.12-0.22	7.4-8.4	<2	High------	0.32		
28:*									
Knoco----------	0-5	<0.06	0.10-0.17	7.9-8.4	<2	High------	0.32	1	4
	5-16	<0.06	0.00-0.08	7.9-8.4	<2	High------	---		
Owens----------	0-6	<0.06	0.13-0.17	7.9-8.4	<2	High------	0.32	1	4
	6-15	<0.06	0.13-0.17	7.9-8.4	<2	High------	0.32		
	15-30	<0.06	0.03-0.08	7.9-8.4	<2	High------	0.37		
29----------	0-10	6.0-20	0.11-0.20	7.4-8.4	<2	Low-------	0.32	5	6
Lincoln	10-60	6.0-20	0.02-0.08	7.9-8.4	<2	Low-------	0.17		
30----------	0-10	0.2-0.6	0.15-0.20	7.9-8.4	<2	Moderate	0.32	5	4
Mangum	10-60	<0.06	0.14-0.18	7.9-8.4	<4	High------	0.32		
31, 32----------	0-12	<0.06	0.14-0.18	7.9-8.4	<2	High------	0.32	5	4
Mangum	12-60	<0.06	0.14-0.18	7.9-8.4	<4	High------	0.32		
33, 34, 35, 36---	0-30	0.6-2.0	0.13-0.24	5.6-7.3	<2	Low-------	0.37	5	5
Minco	30-80	0.6-2.0	0.11-0.24	6.1-8.4	<2	Low-------	0.37		
37, 38, 39-------	0-7	0.6-2.0	0.12-0.18	6.6-7.8	<2	Low-------	0.28	5	5
Motley	7-63	0.6-2.0	0.14-0.20	6.6-8.4	<2	Low-------	0.32		
	63-80	0.6-2.0	0.10-0.16	7.9-8.4	<2	Low-------	0.32		
40:*									
Nebgen----------	0-6	2.0-6.0	0.09-0.14	6.1-7.3	<2	Low-------	0.24	1	3
	6-12	---	---	---	---	----------	---		
Grandfield------	0-9	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low-------	0.24	5	3
	9-70	0.6-2.0	0.11-0.17	6.1-8.4	<2	Low-------	0.32		
Callahan--------	0-10	0.2-0.6	0.15-0.20	6.6-8.4	<2	Low-------	0.32	4	5
	10-35	<0.06	0.12-0.18	7.4-8.4	<2	Moderate	0.32		
	35-60	---	---	---	---	----------	---		
41:*									
Nebgen----------	0-6	2.0-6.0	0.09-0.14	6.1-7.3	<2	Low-------	0.24	1	3
	6-12	---	---	---	---	----------	---		
Owens----------	0-5	<0.06	0.10-0.17	7.9-8.4	<2	High------	0.32	1	4
	5-14	<0.06	0.13-0.17	7.9-8.4	<2	High------	0.32		
	14-30	<0.06	0.03-0.08	7.9-8.4	<2	High------	0.37		
42----------	0-60	0.06-0.2	0.13-0.17	7.4-8.4	<2	Moderate	0.32	5	4
Nipsum	60-80	<0.06	0.10-0.16	7.9-8.4	<2	Moderate	0.32		
43----------	0-17	0.6-2.0	0.15-0.24	5.6-7.8	<2	Moderate	0.37	5	6
Port	17-60	0.6-2.0	0.15-0.24	6.1-8.4	<2	Moderate	0.37		
44*----------	0-25	0.6-2.0	0.15-0.24	5.6-7.8	<2	Moderate	0.37	5	6
Port	25-80	0.6-2.0	0.15-0.24	6.1-8.4	<2	Moderate	0.37		
45:*									
Renfrow----------	0-9	0.6-2.0	0.15-0.24	6.1-7.8	<2	Low-------	0.49	5	5
	9-15	0.2-0.6	0.15-0.22	6.1-7.8	<2	Moderate	0.43		
	15-80	<0.06	0.12-0.22	6.1-8.4	<2	High------	0.43		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Map symbol and soil name	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
							K	T	
	In	In/hr	In/in	pH	Mmhos/cm				
45:*									
Kirkland	0-12	0.6-2.0	0.16-0.24	5.6-7.3	<2	Low	0.49	5	6
	12-34	<0.06	0.12-0.18	6.6-8.4	<2	High	0.37		
	34-80	0.2-0.6	0.12-0.22	7.4-8.4	<2	High	0.32		
Anocon	0-13	2.0-6.0	0.11-0.18	6.1-7.3	<2	Low	0.32	5	5
	13-54	0.2-0.6	0.14-0.18	6.1-7.8	<2	Moderate	0.32		
	54-80	0.2-0.6	0.12-0.18	6.6-8.4	<2	Moderate	0.32		
46:*									
Renfrow	0-9	0.6-2.0	0.15-0.24	6.1-7.8	<2	Low	0.49	5	5
	9-13	0.2-0.6	0.15-0.22	6.1-7.8	<2	Moderate	0.43		
	13-80	<0.06	0.12-0.22	6.1-8.4	<2	High	0.43		
Waurika	0-14	0.6-2.0	0.16-0.20	5.6-7.3	<2	Low	0.49	5	5
	14-39	<0.06	0.13-0.17	6.6-8.4	<2	High	0.37		
	39-80	0.06-0.2	0.15-0.19	7.4-8.4	<2	Moderate	0.37		
47	0-50	<0.06	0.14-0.19	7.9-8.4	<2	Very high	0.32	5	4
Ships	50-60	<0.06	0.14-0.19	7.9-8.4	<2	Very high	0.32		
48	0-15	2.0-6.0	0.07-0.11	5.1-7.3	<2	Low	0.20	3	2
Stephenville	15-33	0.6-2.0	0.11-0.17	5.1-6.5	<2	Low	0.32		
	33-48	---	---	---	---	---	---		
49:*									
Stoneburg	0-12	2.0-6.0	0.11-0.20	5.6-7.3	<2	Low	0.24	2	5
	12-17	0.6-2.0	0.12-0.20	5.6-7.3	<2	Low	0.32		
	17-28	0.2-0.6	0.12-0.20	5.6-7.3	<2	Moderate	0.32		
	28-38	0.2-0.6	0.12-0.20	5.6-7.8	<2	Moderate	0.32		
	38-50	---	---	---	---	---	---		
Bluegrove	0-6	0.6-2.0	0.14-0.19	5.6-7.3	<2	Low	0.28	2	5
	6-30	0.2-0.6	0.15-0.20	5.6-7.8	<2	Moderate	0.32		
	30-48	---	---	---	---	---	---		
50	0-8	2.0-6.0	0.12-0.16	5.6-6.5	<2	Low	0.37	5	5
Teller	8-80	0.6-2.0	0.14-0.18	5.6-6.5	<2	Low	0.32		
51	0-9	6.0-20	0.05-0.11	6.1-7.8	<2	Low	0.17	5	1
Tivoli	9-60	6.0-20	0.02-0.06	6.1-8.4	<2	Low	0.17		
52	0-8	0.06-0.2	0.09-0.16	7.9-9.0	<8	Moderate	0.43	3	4
Treadway	8-30	<0.06	0.08-0.12	7.9-9.0	2-8	High	0.37		
	30-60	<0.06	0.05-0.07	7.9-9.0	4-16	High	0.37		
53	0-17	<0.06	0.10-0.17	7.9-8.4	<2	High	0.32	2	4
Vernon	17-32	<0.06	0.10-0.15	7.9-8.4	<2	High	0.32		
	32-60	<0.06	0.00-0.10	7.9-8.4	<2	High	0.32		
54	0-8	0.6-2.0	0.15-0.20	7.9-8.4	<2	Low	0.43	5	6
Weswood	8-60	0.6-2.0	0.15-0.22	7.9-8.4	<2	Low	0.43		
55	0-60	0.6-2.0	0.10-0.15	7.9-8.4	3-15	Low	0.43	5	6
Weswood Variant									
56:*									
Windthorst	0-9	0.6-2.0	0.12-0.17	5.6-7.3	<2	Low	0.49	5	3
	9-33	0.2-0.6	0.15-0.20	5.6-7.3	<2	Moderate	0.37		
	33-80	0.2-0.6	0.12-0.20	5.6-8.4	<2	Moderate	0.37		
Truce	0-6	0.6-2.0	0.11-0.15	5.6-7.3	<2	Low	0.37	3	3
	6-49	0.06-0.2	0.12-0.18	6.1-8.4	<2	Moderate	0.32		
	49-60	---	---	---	---	---	0.32		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Map symbol and soil name	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
							K	T	
	In	In/hr	In/in	pH	Mmhos/cm				
57----------	0-6	0.6-2.0	0.15-0.19	6.1-7.8	<2	Low-------	0.28	5	5
Winters	6-65	0.2-0.6	0.14-0.18	6.1-7.8	<2	Moderate	0.28		
	65-80	0.6-2.0	0.14-0.18	7.9-8.4	<2	Moderate	0.24		
58, 59*----------	0-60	2.0-6.0	0.16-0.22	7.9-8.4	<2	Low-------	0.49	5	3
Yomont									

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

[See text for definitions of terms such as "brief," "apparent," and "perched." The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
1----- Altus	B	None-----	---	---	3.0-6.0	Perched	Mar-May	>60	---	Low-----	Low.
2, 3, 4, 5----- Bastrop	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	Low.
6:*											
Bluegrove-----	C	None-----	---	---	>6.0	---	---	20-40	Rippable	Moderate	Low.
Stoneburg-----	B	None-----	---	---	>6.0	---	---	20-40	Rippable	Moderate	Low.
7----- Bonti	C	None-----	---	---	>6.0	---	---	20-40	Rippable	High-----	Moderate.
8----- Chaney	C	None-----	---	---	>6.0	---	---	>60	---	High-----	Moderate.
9----- Cisco	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	Low.
10:*											
Darnell-----	C	None-----	---	---	>6.0	---	---	10-20	Rippable	Low-----	Moderate.
Truce-----	C	None-----	---	---	>6.0	---	---	40-60	Rippable	High-----	Low.
11, 12----- Deandale	D	None-----	---	---	>6.0	---	---	>60	---	High-----	Moderate.
13, 14, 15, 16---- Devol	B	None-----	---	---	>6.0	---	---	>60	---	Low-----	Low.
17----- Duffau	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	Low.
18, 19, 20, 21, 22----- Enterprise	B	None-----	---	---	>6.0	---	---	>60	---	Low-----	Low.
23*----- Gowen	B	Frequent----	Brief-----	May-Sep	>6.0	---	---	>60	---	Moderate	Low.
24, 25----- Grandfield	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	Low.
26----- Kamay	D	None-----	---	---	>6.0	---	---	>60	---	High-----	Moderate.
27----- Kirkland	D	None-----	---	---	>6.0	---	---	>60	---	High-----	Low.
28:*											
Knoco-----	D	None-----	---	---	>6.0	---	---	3-12	Rippable	High-----	Low.
Owens-----	D	None-----	---	---	>6.0	---	---	10-20	Rippable	High-----	Low.
29----- Lincoln	A	Frequent----	Very brief to brief.	Apr-Oct	5.0-8.0	Apparent	Nov-May	>60	---	Low-----	Low.
30, 31----- Mangum	D	Occasional	Very brief	Apr-Nov	>6.0	---	---	>60	---	High-----	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
32---------- Mangum	D	Frequent----	Very brief	Apr-Nov	>6.0	---	---	>60	---	High-----	Low.
33, 34, 35, 36---- Minco	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low.
37, 38, 39-------- Motley	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
40:*											
Nebgen----------	D	None--------	---	---	>6.0	---	---	4-14	Rippable	Low------	Low.
Grandfield-------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
Callahan---------	D	None--------	---	---	>6.0	---	---	24-40	Rippable	High-----	Low.
41:*											
Nebgen----------	D	None--------	---	---	>6.0	---	---	6-12	Rippable	Low------	Low.
Owens-----------	D	None--------	---	---	>6.0	---	---	10-20	Rippable	High-----	Low.
42---------- Nipsum	C	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
43---------- Port	B	Occasional	Very brief to brief.	Mar-Aug	>6.0	---	---	>60	---	Moderate	Low.
44*---------- Port	B	Frequent----	Very brief to brief.	Mar-Aug	>6.0	---	---	>60	---	Moderate	Low.
45:*											
Renfrow----------	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Kirkland---------	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Anocon-----------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
46:*											
Renfrow----------	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Waurika----------	D	None--------	---	---	1.0-2.0	Perched	Mar-May	>60	---	High-----	Moderate.
47---------- Ships	D	Occasional	Brief-----	May-Oct	>6.0	---	---	>60	---	High-----	Low.
48---------- Stephenville	B	None--------	---	---	>6.0	---	---	20-40	Rippable	Moderate	Moderate.
49:*											
Stoneburg--------	B	None--------	---	---	>6.0	---	---	20-40	Rippable	Moderate	Low.
Bluegrove--------	C	None--------	---	---	>6.0	---	---	20-40	Rippable	Moderate	Low.
50---------- Teller	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate.
51---------- Tivoli	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low.
52---------- Treadway	D	Occasional--	Very brief	Apr-Oct	>6.0	---	---	>60	---	High-----	High.
53---------- Vernon	D	None--------	---	---	>6.0	---	---	20-40	Rippable	High-----	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
54---------- Weswood	B	Occasional	Brief-----	Mar-Sep	>6.0	---	---	>60	---	High-----	Low.
55---------- Weswood Variant	B	Occasional	Very brief	May-Sep	>6.0	---	---	>60	---	High-----	Low.
56:*											
Windthorst-------	C	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Truce----------	C	None--------	---	---	>6.0	---	---	40-60	Rippable	High-----	Low.
57---------- Winters	C	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
58---------- Yomont	B	Occasional	Very brief	Apr-Nov	>6.0	---	---	>60	---	Low------	Low.
59*---------- Yomont	B	Frequent----	Very brief	Apr-Nov	>6.0	---	---	>60	---	Low------	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
*Altus	Fine-loamy, mixed, thermic Pachic Argiustolls
Anocon	Fine, mixed, thermic Udic Argiustolls
Bastrop	Fine-loamy, mixed, thermic Udic Paleustalfs
Bluegrove	Fine, mixed, thermic Udic Haplustalfs
Bonti	Fine, mixed, thermic Ultic Paleustalfs
Callahan	Fine, mixed, thermic Typic Haplustalfs
*Chaney	Fine, mixed, thermic Aquic Paleustalfs
Cisco	Fine-loamy, siliceous, thermic Udic Haplustalfs
Darnell	Loamy, siliceous, thermic, shallow Udic Ustochrepts
Deandale	Fine, mixed, thermic Typic Natrustolls
Devol	Coarse-loamy, mixed, thermic Udic Haplustalfs
Duffau	Fine-loamy, siliceous, thermic Udic Paleustalfs
Enterprise	Coarse-silty, mixed, thermic Typic Ustochrepts
Gowen	Fine-loamy, mixed, thermic Cumulic Haplustolls
Grandfield	Fine-loamy, mixed, thermic Udic Haplustalfs
Kamay	Fine, mixed, thermic Typic Paleustalfs
Kirkland	Fine, mixed, thermic Udertic Paleustolls
Knoco	Clayey, mixed (calcareous), thermic, shallow Ustic Torriorthents
Lincoln	Sandy, mixed, thermic Typic Ustifluvents
Mangum	Fine, mixed, thermic Vertic Ustochrepts
Minco	Coarse-silty, mixed, thermic Udic Haplustolls
Motley	Fine-loamy, mixed, thermic Udic Paleustolls
Nebgen	Loamy, mixed, nonacid, thermic, shallow Typic Ustorthents
Nipsum	Fine, mixed, thermic Cumulic Haplustolls
Owens	Clayey, mixed, thermic, shallow Typic Ustochrepts
Port	Fine-silty, mixed, thermic Cumulic Haplustolls
Renfrow	Fine, mixed, thermic Udertic Paleustolls
Ships	Very-fine, mixed, thermic Udic Chromusterts
Stephenville	Fine-loamy, siliceous, thermic Ultic Haplustalfs
Stoneburg	Fine-loamy, mixed, thermic Udic Argiustolls
*Teller	Fine-loamy, mixed, thermic Udic Argiustolls
*Tivoli	Mixed, thermic Typic Ustipsamments
Treadway	Fine, mixed, thermic Ustertic Camborthids
Truce	Fine, mixed, thermic Udic Paleustalfs
Vernon	Fine, mixed, thermic Typic Ustochrepts
Waurika	Fine, montmorillonitic, thermic Typic Argialbolls
Weswood	Fine-silty, mixed, thermic Fluventic Ustochrepts
Weswood Variant	Fine-silty, mixed, thermic Fluventic Camborthids
Windthorst	Fine, mixed, thermic Udic Paleustalfs
Winters	Fine, mixed, thermic Udic Paleustalfs
Yomont	Coarse-silty, mixed (calcareous), thermic Typic Ustifluvents

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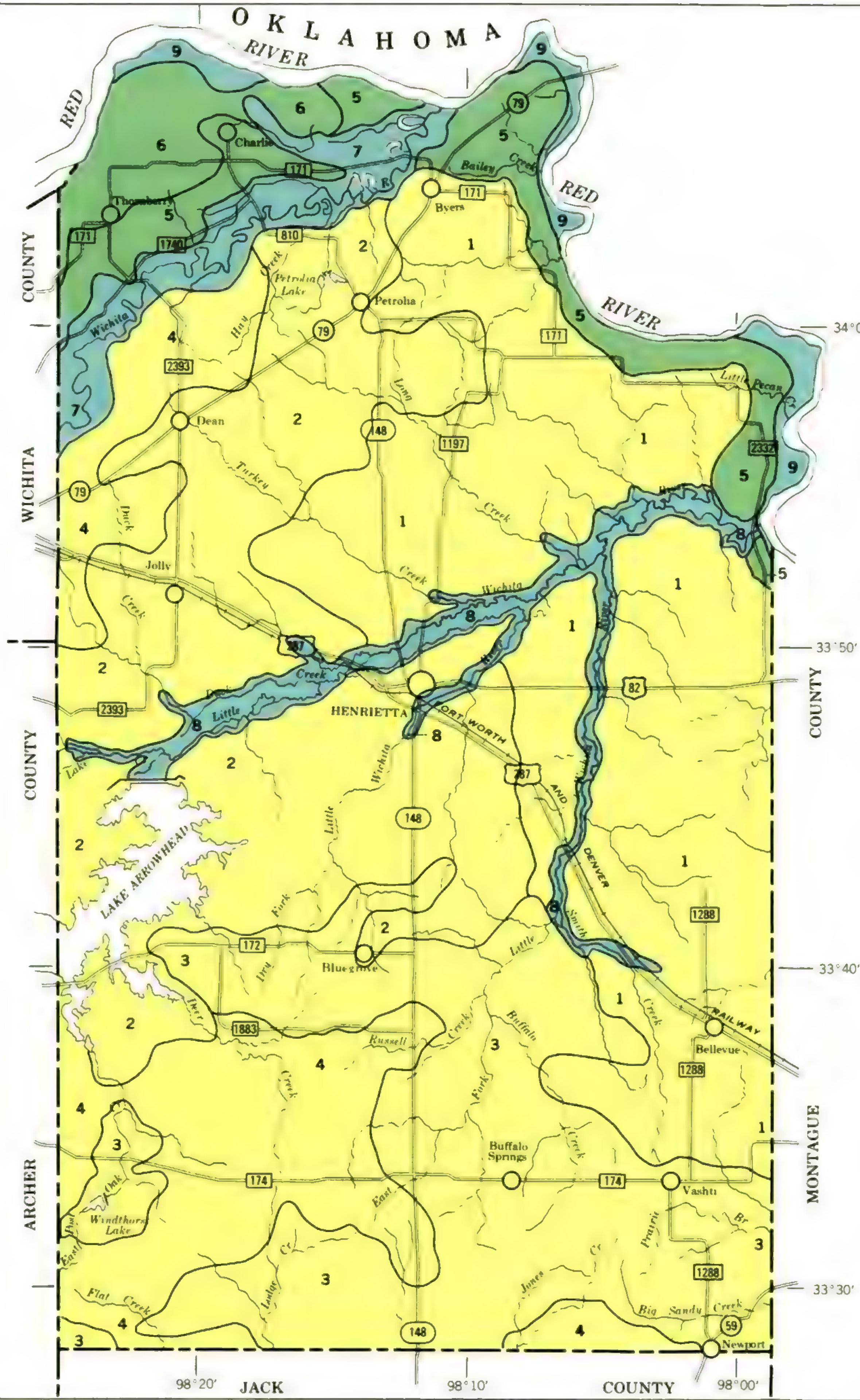


LEGEND

DOMINANTLY MODERATELY DEEP AND DEEP SOILS THAT FORMED MAINLY IN MATERIAL WEATHERED FROM SANDSTONE AND SHALE ON UPLANDS

1 Stoneburg-Anocon-Kirkland: Nearly level to gently sloping, well drained loamy soils

2 Kamay-Bluegrove-Deandale: Nearly level to gently sloping, well drained and moderately well drained loamy soils

3 Bonti-Windthorst-Truce: Gently sloping, well drained to moderately well drained loamy soils

4 Renfrow-Bluegrove-Waurika: Nearly level to gently sloping, well drained to somewhat poorly drained loamy soils

DOMINANTLY DEEP SOILS THAT FORMED IN EOLIAN AND ALLUVIAL SEDIMENTS ON UPLANDS

5 Teller-Minco-Motley: Nearly level to sloping well drained loamy soils

6 Devol-Enterprise: Nearly level to moderately steep well drained sandy and loamy soils

DEEP SOILS THAT FORMED IN ALLUVIUM ON FLOOD PLAINS

7 Weswood-Mangum: Nearly level, well drained to moderately well drained loamy and clayey soils

8 Ships-Mangum: Nearly level, moderately well drained clayey soils

9 Yomont-Lincoln: Nearly level to gently sloping, well drained and somewhat excessively drained loamy soils

Those parts of Jefferson and Cotton Counties, Oklahoma south of the Red River channel but north of the Texas-Oklahoma boundary are included in this survey area. Soil names from this survey area were used, and the names may differ from those in the published surveys of Jefferson County and Cotton County. Although the names may differ, the soils are parallel or closely similar.

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts

Compiled 1979

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

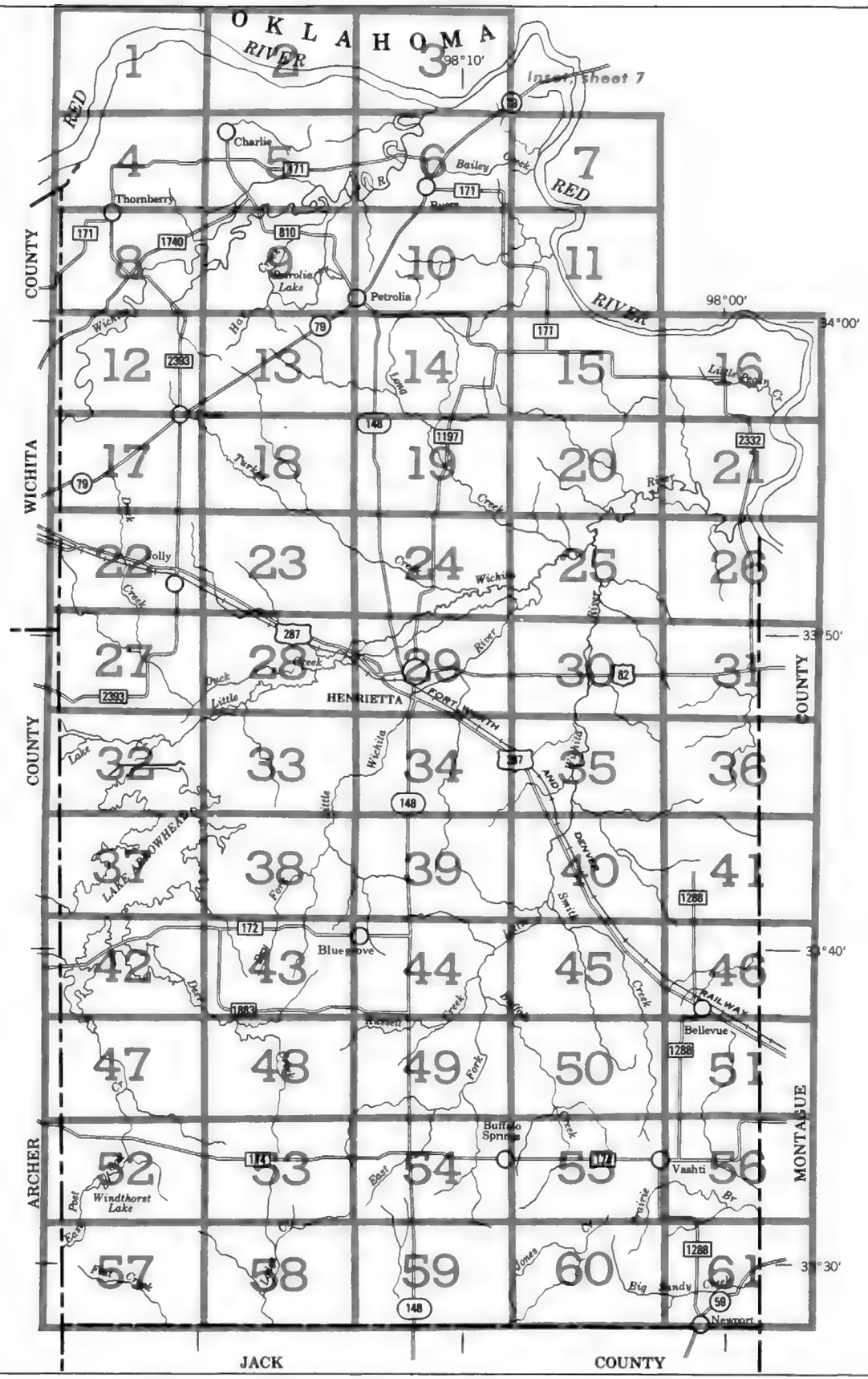
CLAY COUNTY, TEXAS

N

Scale 1:316,800

1 0 1 2 3 4 5 Miles

1 0 5 10 Km



Those parts of Jefferson and Cotton Counties, Oklahoma south of the Red River channel but north of the Texas-Oklahoma boundary are included in this survey area. Soil names from this survey area were used, and the names may differ from those in the published surveys of Jefferson County and Cotton County. Although the names may differ, the soils are parallel or closely similar.

Original text from each individual map sheet read:

This map is compiled on 1976 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

INDEX TO MAP SHEETS

CLAY COUNTY, TEXAS

N

Scale 1:316,800

1 0 1 2 3 4 5 Miles

1 0 5 10 Km

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline
- AD HOC BOUNDARY (label)
- Small airport, airfield, park, oilfield, cemetery, or flood pool

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate
- Federal
- State
- County, farm or ranch

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label)
- Located object (label)
- Tank (label)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial
- Intermittent

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Oil waste land

SOIL LEGEND

Most units in the legend are narrowly defined. Soil names followed by the superscript 1/ are broadly defined units. These units will be footnoted in the legend of the published soil survey. The broadly defined units were mapped at a lower intensity and in larger delineations but mapping has been controlled well enough to be interpreted for the expected use of the soils. Map symbols will be published as arabic numbers.

SYMBOL	NAME
1	Altus fine sandy loam, 0 to 3 percent slopes
2	Bastrop fine sandy loam, 0 to 1 percent slopes
3	Bastrop fine sandy loam, 1 to 3 percent slopes
4	Bastrop fine sandy loam, 3 to 5 percent slopes
5	Bastrop fine sandy loam, 5 to 8 percent slopes
6	Bluegrove-Stoneburg association, gently sloping 1/
7	Bonti fine sandy loam, 1 to 5 percent slopes
8	Chaney loamy fine sand, 0 to 3 percent slopes
9	Cisco fine sandy loam, 1 to 5 percent slopes
10	Darnell-Truce complex, 3 to 12 percent slopes
11	Deandale silt loam, 0 to 1 percent slopes
12	Deandale silt loam, 1 to 3 percent slopes
13	Devol loamy fine sand, 0 to 3 percent slopes
14	Devol loamy fine sand, 3 to 8 percent slopes
15	Devol fine sandy loam, 0 to 1 percent slopes
16	Devol fine sandy loam, 1 to 3 percent slopes
17	Duffau loamy fine sand, 1 to 5 percent slopes
18	Enterprise very fine sandy loam, 0 to 1 percent slopes
19	Enterprise very fine sandy loam, 1 to 3 percent slopes
20	Enterprise very fine sandy loam, 3 to 5 percent slopes
21	Enterprise very fine sandy loam, 5 to 8 percent slopes
22	Enterprise very fine sandy loam, 8 to 20 percent slopes
23	Gowen soils, frequently flooded
24	Grandfield loamy fine sand, 0 to 3 percent slopes
25	Grandfield fine sandy loam, 1 to 5 percent slopes
26	Kamay silt loam, 1 to 3 percent slopes
27	Kirkland silt loam, 0 to 1 percent slopes
28	Knoco-Owens association, undulating 1/
29	Lincoln fine sandy loam, frequently flooded
30	Mangum silty clay loam, occasionally flooded
31	Mangum clay, occasionally flooded
32	Mangum clay, frequently flooded
33	Minco very fine sandy loam, 0 to 1 percent slopes
34	Minco very fine sandy loam, 1 to 3 percent slopes
35	Minco very fine sandy loam, 3 to 5 percent slopes
36	Minco very fine sandy loam, 5 to 8 percent slopes
37	Motley loam, 0 to 1 percent slopes
38	Motley loam, 1 to 3 percent slopes
39	Motley loam, 3 to 5 percent slopes
40	Nebgen-Grandfield-Callahan association, sloping 1/
41	Nebgen-Owens complex, 3 to 25 percent slopes
42	Nipsum clay loam, 0 to 2 percent slopes
43	Port clay loam, occasionally flooded
44	Port soils, frequently flooded
45	Renfrow-Kirkland-Anocon association, nearly level 1/
46	Renfrow-Waurika complex, 0 to 2 percent slopes
47	Ships clay, occasionally flooded
48	Stephenville loamy fine sand, 0 to 3 percent slopes
49	Stoneburg-Bluegrove association, gently sloping 1/
50	Teller loam, 0 to 1 percent slopes
51	Tivoli fine sand
52	Treadway clay, 0 to 2 percent slopes
53	Vernon clay, 1 to 5 percent slopes
54	Weswood silt loam, occasionally flooded
55	Weswood Variant, occasionally flooded
56	Windthorst-Truce complex, 1 to 5 percent slopes
57	Winters loam, 1 to 3 percent slopes

CLAY COUNTY, TEXAS — SHEET NUMBER 1

1 780 000 FEET

905 000 FEET

RIVER

OKLAHOMA

BOUNDARY

COUNTY

COTTON

RED

ARBUCKLE

(Joins sheet 2)

(Joins sheet 4)

1 745 000 FEET

890 000 FEET

N

2 Miles

10000 Feet

Scale 1:24000

1 5000 0 1000 2000 3000 4000 5000

CLAY COUNTY, TEXAS — SHEET NUMBER 2

(2)

N

1 775 000 FEET

2 Miles

10000 Feet

5000

Scale 1:24000

0 1000 2000 3000 4000 5000

(Joins sheet 1)

RED

RIVER

COTTON COUNTY OKLAHOMA BOUNDARY

Pumpkin Ridge

890 000 FEET

1 750 000 FEET

(Joins sheet 5)

(Joins sheet 3)

CLAY COUNTY, TEXAS — SHEET NUMBER 3

3

N

1 780 000 FEET

805 000 FEET

(Joins sheet 2)

RED RIVER

COTTON COUNTY

OKLAHOMA

WICHITA RIVER

RED RIVER

JEFFERSON COUNTY

(Joins inset, sheet 7)

(Joins sheet 6)

1 805 000 FEET

2 Miles

10000 Feet

1

5000

Scale 1:24000

0 1000 2000 3000 4000 5000

805 000 FEET

CLAY COUNTY, TEXAS — SHEET NUMBER 4

(4)

(Joins sheet 1)

N

Scale 1:24000

2 Miles 1 0 1 2 3 4 5

10000 Feet 5000 0 1000 2000 3000 4000 5000

1 745 000 FEET

875 000 FEET

OKLAHOMA

RED RIVER COUNTY

COTTON

WICHITA COUNTY

Thornberry

171

1 720 000 FEET

(Joins sheet 8)

(Joins sheet 5)

CLAY COUNTY, TEXAS — SHEET NUMBER 5

1 750 000 FEET

(Joins sheet 2)

5

N

2 Miles

10000 Feet

Scale 1:24000

5000

0

1000

2000

3000

4000

5000

885 000 FEET

870 000 FEET

(Joins sheet 4)

(Joins sheet 6)

(Joins sheet 9)

1 775 000 FEET

Pumpkin Ridge

Pumpkin Ridge

Charlie

Byers Lake

water

RIVER

WICHITA

RIVER

WICHITA

Creek

Hall

810

171

1740

CLAY COUNTY, TEXAS — SHEET NUMBER 6

(6)

N

(Joins sheet 3)

Gilbert Lake

RIVER

WICHITA

Byers

water

Bailey Creek

(Joins sheet 5)

(Joins sheet 7)

(Joins sheet 10)

2 Miles

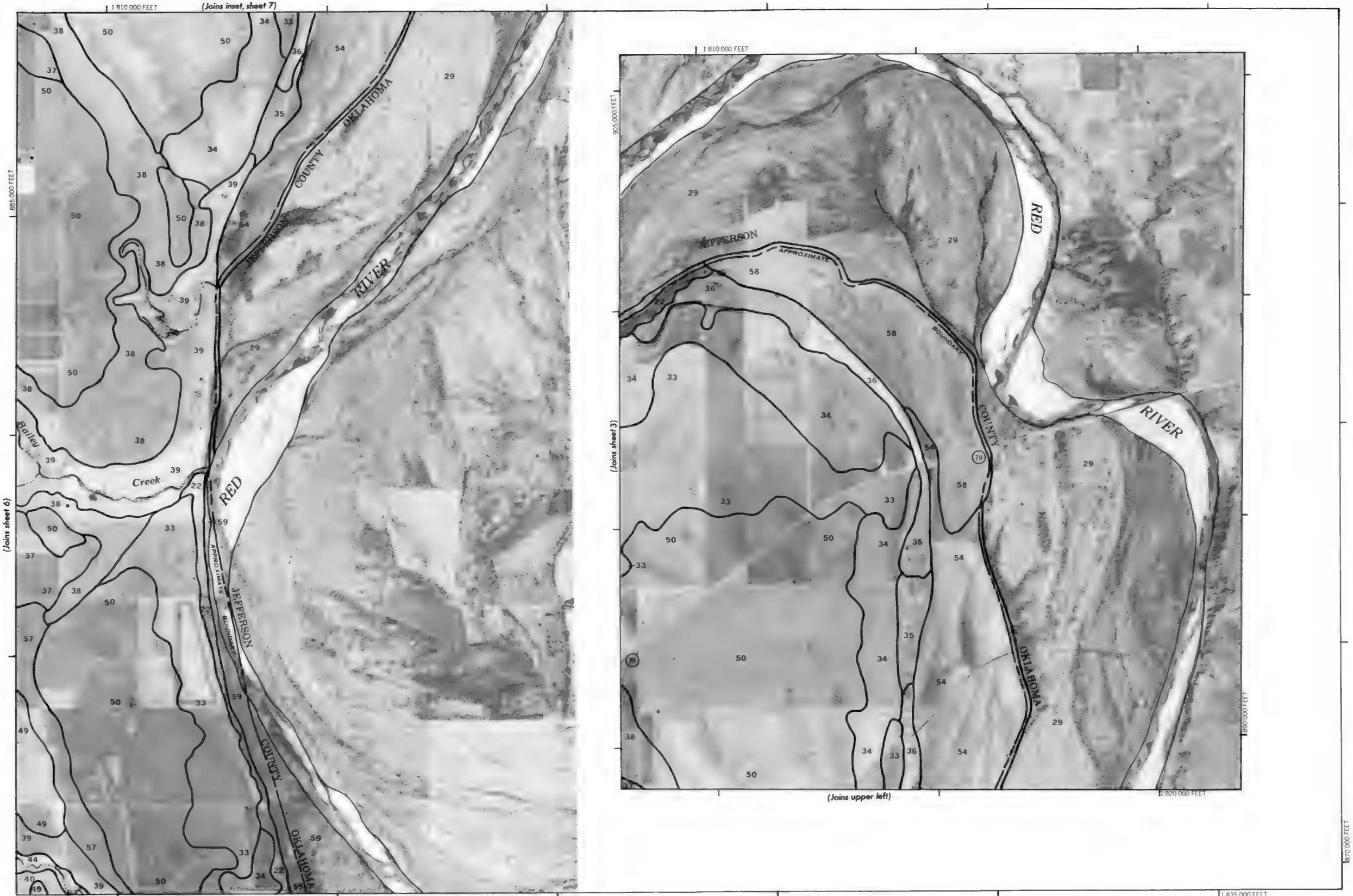
10000 Feet

Scale 1:24000

5000 0 1000 2000 3000 4000 5000

870000 FEET

CLAY COUNTY, TEXAS — SHEET NUMBER 7



8

N

(Joins sheet 4)

1 745 000 FEET

8/0 000 FEET

2 Miles

10000 Feet

5000

1

Scale 1:24000

0 0 1000 2000 3000 4000 5000

½ ¼ ½ ¾ 1

8/5 000 FEET

COUNTY

WICHITA

WICHITA

WICHITA

RIVER

RIVER

GRAVEL PIT

GRAVEL PIT

GRAVEL PIT

NORTH SIDE CANAL

water

1177

171

1177

2393

1740

1740

2393

(Joins sheet 9)

1 720 000 FEET

CLAY COUNTY, TEXAS — SHEET NUMBER 9

1 750 000 FEET

(Joins sheet 5)

(Joins sheet 8)

(Joins sheet 10)

(Joins sheet 13)

1 775 000 FEET

855 000 FEET

9

N

2 Miles

10000 Feet

Scale 1:24000

RIVER

WICHITA

Creek

Hay

Creek

Hay

Petrolia Reservoirs

water

Petrolia

(10)

(Joins sheet 6)

CLAY COUNTY, TEXAS — SHEET NUMBER 10

N

2 Miles

10000 Feet

1

5000

(Joins sheet 9)

Scale 1:24000

0 0 1000 2000 3000 4000 5000

1 805 000 FEET

870 000 FEET

water

Petrolia

2332

171

1 780 000 FEET

(Joins sheet 14)

(Joins sheet 11)

CLAY COUNTY, TEXAS — SHEET NUMBER 11

11

1 810 000 FEET

(Joins sheet 7)

870 000 FEET

RED

JEFFERSON

APPROXIMATE

COUNTY

BOUNDARY

RIVER

OKLAHOMA

(Joins sheet 10)

(Joins sheet 15)

1 835 000 FEET

N

2 Miles

10000 Feet

Scale 1:24000

(Joins sheet 8)

(Joins sheet 13)

(Joins sheet 17)

12

N

2 Miles 10000 Feet

1 5000

Scale 1:24000

0 0

½ 1000

½ 2000

½ 3000

½ 4000

1 5000

COUNTY

WICHITA

WICHITA

RIVER

Bear Creek

water

water

water

1740

2393

79

CLAY COUNTY, TEXAS — SHEET NUMBER 13

1 750 000 FEET

850 000 FEET

(Joins sheet 9)

(Joins sheet 12)

(Joins sheet 14)

(Joins sheet 18)

1 775 000 FEET

835 000 FEET

13

N

2 Miles

10000 Feet

Scale 1:24000

water

Long Creek

water

CLAY COUNTY, TEXAS — SHEET NUMBER 14

(14)

N

(Joins sheet 10)

1,805,000 FEET

850,000 FEET

2 Miles

10000 Feet

5000

(Joins sheet 13)

Scale 1:24000

4000 3000 2000 1000 0 1

OIL WASTE LAND

water

Long Creek

Humville

1,780,000 FEET

(Joins sheet 19)

(Joins sheet 15)

CLAY COUNTY, TEXAS — SHEET NUMBER 15

(Joins sheet 11)

15

N

1 810 000 FEET

850 000 FEET

RED RIVER COUNTY

JEFFERSON

APPROXIMATE

OKLAHOMA BOUNDARY

Riverland Community

171

2332

water

835 000 FEET

(Joins sheet 14)

(Joins sheet 16)

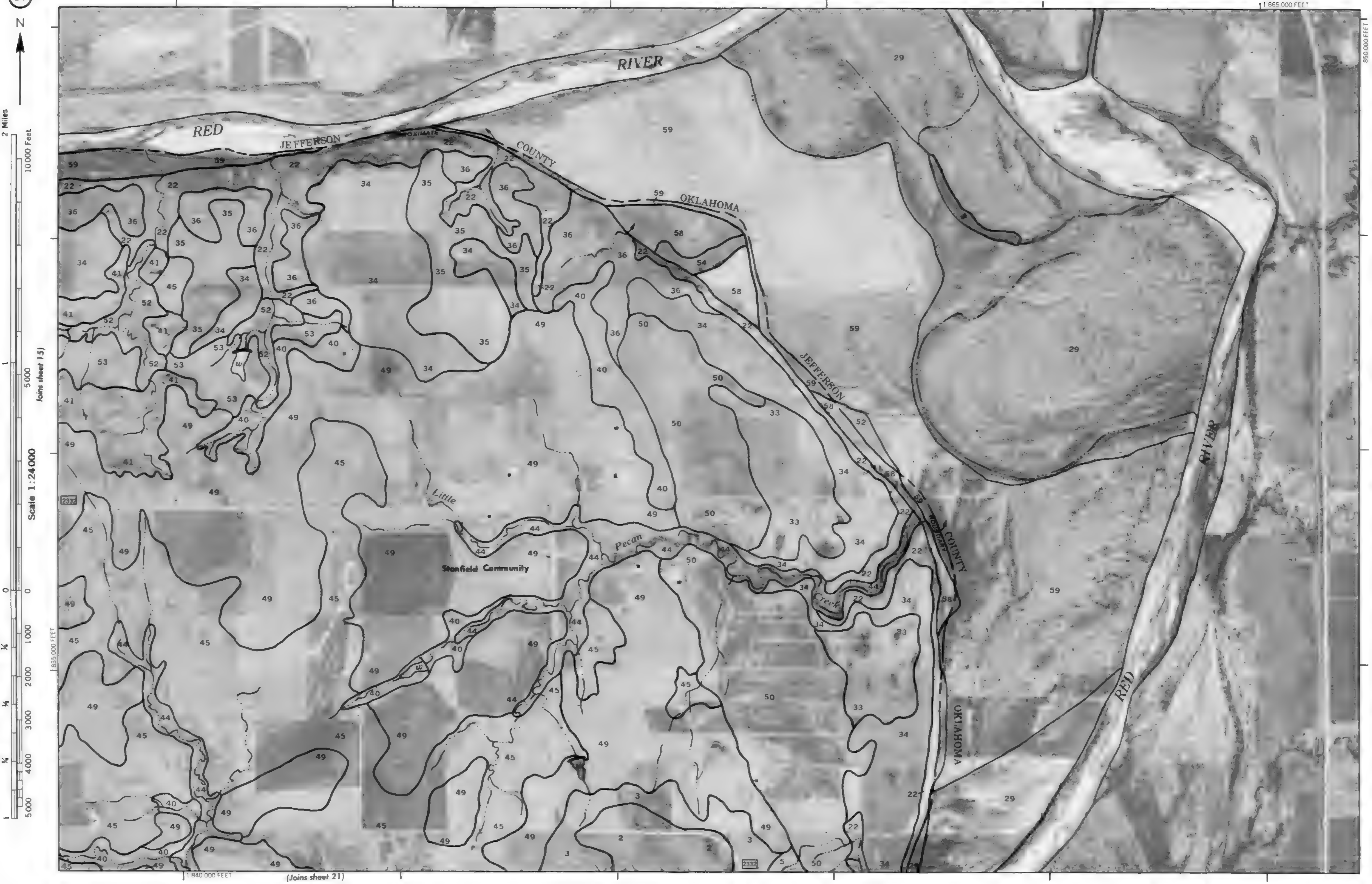
(Joins sheet 20)

2 Miles

10000 Feet

5000

Scale 1:24000


N
2 Miles
10000 Feet
5000
0
1000
2000
3000
4000
5000
Scale 1:24000
(Joins sheet 15)
(Joins sheet 21)
1 865 000 FEET
850 000 FEET
835 000 FEET
1 840 000 FEET
RED
RIVER
JEFFERSON
COUNTY
OKLAHOMA
Little
Pecan
Creek
Stanfield Community
2332

CLAY COUNTY, TEXAS — SHEET NUMBER 17

(Joins sheet 12)

17

N

2 Miles

10000 Feet

(Joins sheet 18)

5000

Scale 1:24000

COUNTY

WICHITA

RIVER

Dean

Turkey Creek

Duck Creek

water

(Joins sheet 22)

CLAY COUNTY, TEXAS — SHEET NUMBER 18

(18)

N

(Joins sheet 13)

(Joins sheet 17)

(Joins sheet 19)

(Joins sheet 23)

Scale 1:24000

2 Miles 10000 Feet

1 5000 0 1000 2000 3000 4000 5000

Turkey Creek

Turkey Creek

CLAY COUNTY, TEXAS — SHEET NUMBER 19

1 780 000 FEET

(Joins sheet 14)

830 000 FEET

(Joins sheet 18)

(Joins sheet 20)

(Joins sheet 24)

805 000 FEET

19

N

2 Miles

10000 Feet

Scale 1:24000

Long Creek

water

Long

CLAY COUNTY, TEXAS — SHEET NUMBER 20

(20)

(Joins sheet 15)

N

2 Miles

10000 Feet

Scale 1:24000

(Joins sheet 19)

(Joins sheet 21)

(Joins sheet 25)

Wichita

Little

CLAY COUNTY, TEXAS — SHEET NUMBER 21

(Joins sheet 16)

(Joins sheet 20)

(Joins sheet 26)

OKLAHOMA

RED RIVER

COUNTY

JEFFERSON

RED RIVER

Little Wichita River

Little Wichita

water

21

N

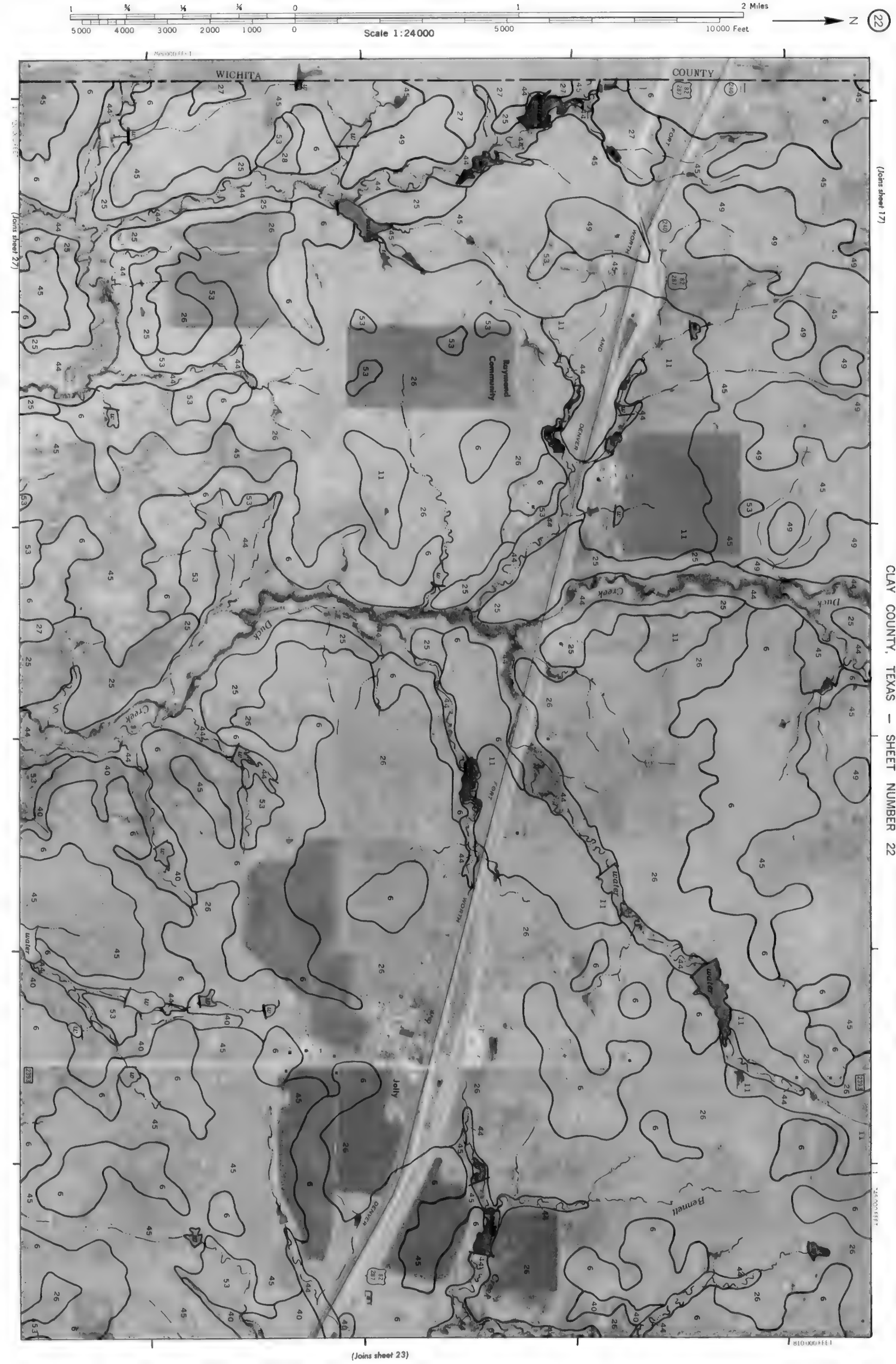
2 Miles

10000 Feet

1

5000

Scale 1:24000


1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000
N
22
WICHITA COUNTY
Raymond Community
Duck Creek
Jolly
Rennell
water
(Joins sheet 17)
(Joins sheet 27)
(Joins sheet 23)
CLAY COUNTY, TEXAS — SHEET NUMBER 22

CLAY COUNTY, TEXAS — SHEET NUMBER 23

1 750 000 FEET

1 810 000 FEET

(Joins sheet 18)

(Joins sheet 22)

(Joins sheet 24)

(Joins sheet 28)

1 7 5000 FEET

Turkey Creek

Bennett Creek

Creek

FORT WORTH AND DENVER

82 287

23

N

2 Miles

10000 Feet

1

5000

Scale 1:24000

0 1000 2000 3000 4000 5000

(Joins sheet 19)

(Joins sheet 25)

(Joins sheet 29)

(Joins sheet 23)

1,805,000 FEET

34°00'00" FEET

N

Scale 1:24000

2 Miles 10000 Feet

1 5000

Turkey Creek

Long Creek

Little Wichita River

Dry Fork Little Wichita River

Wichita River

water

CLAY COUNTY, TEXAS — SHEET NUMBER 25

1 810 000 FEET

(Joins sheet 20)

25

N

2 Miles

10000 Feet

5000

Scale 1:24000

(Joins sheet 26)

(Joins sheet 24)

1 835 000 FEET

(Joins sheet 30)

(Joins sheet 21)

26

N

Scale 1:24000

2 Miles 0 1

10000 Feet 0 5000

(Joins sheet 25)

1 865 000 FEET

810 000 FEET

795 000 FEET

(Joins sheet 31)

1 840 000 FEET

Little River

Wichita

RED RIVER

APPROXIMATE JEFFERSON COUNTY OKLAHOMA BOUNDARY

COUNTY

MONTAGUE

2332

CLAY COUNTY, TEXAS — SHEET NUMBER 27

1 720 000 FEET

(Joins sheet 22)

27

N

WICHITA COUNTY

COUNTY

ARCHER

Duck Creek

water

2393

1954

(Joins sheet 28)

(Joins sheet 32)

1 245 000 FEET

2 Miles

10 000 Feet

Scale 1:24000

CLAY COUNTY, TEXAS — SHEET NUMBER 28

28

N

(Joins sheet 23)

1 775 000 FEET

2 Miles

10000 Feet

5000

Scale 1:24000

0 1000 2000 3000 4000 5000

(Joins sheet 27)

Bennett

Fort Worth and Denver

River

Wichita

Creek

Duck

Creek

Little

Creek

River

Wichita

Duck

Little

(Joins sheet 29)

(Joins sheet 33)

1 750 000 FEET

CLAY COUNTY, TEXAS — SHEET NUMBER 29

(Joins sheet 24)

29

N

2 Miles

10000 Feet

(Joins sheet 30)

5000

Scale 1:24000

(Joins sheet 28)

(Joins sheet 34)

Wichita River

Little Wichita River

water Reservoir

SEWAGE DISPOSAL

HENRIETTA

FORT WORTH AND DENVER

Little Wichita River

AIRSTRIP

CLAY COUNTY, TEXAS — SHEET NUMBER 30

30

N

(Joins sheet 25)

1 835 000 FEET

2 Miles

10000 Feet

Scale 1:24000

5000

(Joins sheet 29)

water

Little Wichita River

Little

East

(Joins sheet 31)

775 000 FEET

1 810 000 FEET

(Joins sheet 35)

CLAY COUNTY, TEXAS — SHEET NUMBER 31

(Joins sheet 26)

(Joins sheet 30)

(Joins sheet 36)

COUNTY

MONTAGUE

Creek

Beaver

water

N

2 Miles

10000 Feet

Scale 1:24000

CLAY COUNTY, TEXAS — SHEET NUMBER 32

(Joins sheet 27)

N

2 Miles 10000 Feet

1 5000

Scale 1:24000

1 0 ½ 0 1 ½ 2 2 ½ 3 3 ½ 4 4 ½ 5 5000 Feet

COUNTY

Sloop Creek

Sloop Pond

Lake

water

1954

LAKE

ARROWHEAD

STATE

PARK

ARCHER

Creek

Little Wichita River

WICHITA FALLS DAM

FLOOD POOL LINE

LAKE ARROWHEAD

(Joins sheet 37)

(Joins sheet 33)

CLAY COUNTY, TEXAS — SHEET NUMBER 33

1 750 000 FEET

770 000 FEET

(Joins sheet 28)

(Joins sheet 32)

(Joins sheet 34)

(Joins sheet 38)

1 775 000 FEET

755 000 FEET

33

N

2 Miles

10000 Feet

Scale 1:24000

0 ½ 1 ½ 2 ½ 3 ½ 4 ½ 5 5000 0 1000 2000 3000 4000 5000

water

FLOOD LINE

LAKE ARROWHEAD

Wichita River

Little Wichita River Fork

Dry

CLAY COUNTY, TEXAS — SHEET NUMBER 34

(Joins sheet 29)

(Joins sheet 33)

(Joins sheet 39)

(Joins sheet 35)

1 805 000 FEET

1 780 000 FEET

Scale 1:24000

2 Miles 10000 Feet

Wichita River

Little Wichita River

Dry Fork

FORT WORTH AND DENVER

CLAY COUNTY, TEXAS — SHEET NUMBER 35

1 810 000 FEET

(Joins sheet 30)

35

N

2 Miles

10000 Feet

(Joins sheet 34)

(Joins sheet 36)

Wichita River

Little Wichita River

FORT WORTH AND DENVER

Scale 1:24000

1 755 000 FEET

(Joins sheet 40)

1 835 000 FEET

CLAY COUNTY, TEXAS — SHEET NUMBER 36

(36)

(Joins sheet 31)

1 865 000 FEET

N

2 Miles

10000 Feet

5000

(Joins sheet 35)

Scale 1:24000

1 0 1 2 3 4 Miles

5000 0 5000 10000 15000 20000 25000 30000 35000 40000 FEET

1 755 000 FEET

1 840 000 FEET

(Joins sheet 41)

7 000 FEET

Beaver Creek

COUNTY

MONTAGUE

Canyon Creek

CLAY COUNTY, TEXAS — SHEET NUMBER 37

(Joins sheet 32)

37

1 720 000 FEET

750 000 FEET

LAKE

ARROWHEAD

COUNTY

ARCHER

FLOOD POOL LINE

(Joins sheet 38)

(Joins sheet 42)

1 745 000 FEET

N

2 Miles

10000 Feet

Scale 1:24000

(38)

N

2 Miles 10000 Feet

1 5000

Scale 1:24000

0 1000 2000 3000 4000 5000

(Joins sheet 33)

1 775 000 FEET

LAKE ARROWHEAD

FLOOD POOL LINE 2606

2606

Wichita River

Little Wichita River

Dry Fork

water

(Joins sheet 37)

(Joins sheet 39)

(Joins sheet 43)

1 750 000 FEET

CLAY COUNTY, TEXAS — SHEET NUMBER 39

(Joins sheet 34)

1 780 000 FEET

750 000 FEET

(Joins sheet 38)

water

(Joins sheet 40)

735 000 FEET

1 805 000 FEET

(Joins sheet 44)

39

N

2 Miles

10000 Feet

5000

Scale 1:24000

0 1000 2000 3000 4000 5000

CLAY COUNTY, TEXAS — SHEET NUMBER 40

40

N

(Joins sheet 35)

1 835 000 FEET

750 000 FEET

(Joins sheet 39)

(Joins sheet 41)

735 000 FEET

1 810 000 FEET

(Joins sheet 45)

Scale 1:24000

2 Miles 10000 Feet

1 0 1

5000 4000 3000 2000 1000 0 5000

Wichita River

Little Wichita River

Fork Smith Creek

Denver

287

CLAY COUNTY, TEXAS — SHEET NUMBER 41

41

1 840 000 FEET

(Joins sheet 36)

750 000 FEET

Canyon

Creek

water

COUNTY

MONTAGUE

(Joins sheet 40)

(Joins sheet 46)

1 865 000 FEET

735 000 FEET

N

2 Miles

10000 Feet

Scale 1:24000

1 5000 0 1000 2000 3000 4000 5000

(Joins sheet 37)

(Joins sheet 43)

(Joins sheet 47)

42

N

Scale 1:24000

2 Miles 1 0 1

10000 Feet 5000 0 5000

1 245 000 FEET

1 250 000 FEET

LAKE ARROWHEAD

LAKE ARROWHEAD

COUNTY

ARCHER

FLOOD POOL LINE

water

Little Post Oak Creek

Deer Creek

172

CLAY COUNTY, TEXAS — SHEET NUMBER 43

43

1 750 000 FEET

(Joins sheet 38)

(Joins sheet 42)

(Joins sheet 44)

(Joins sheet 48)

1 775 000 FEET

N

2 Miles

10000 Feet

5000

Scale 1:24000

WICHITA River

Little Dry Fork

Russell Creek

Deer Creek

1883

172

(44)

(Joins sheet 39)

(Joins sheet 43)

(Joins sheet 45)

(Joins sheet 49)

N

Scale 1:24000

2 Miles 1 0 1 2 3 4 5 6 7 8 9 10 Kilometers

10000 Feet 5000 0 1000 2000 3000 4000 5000 Feet

1 805 000 FEET

1 780 000 FEET

730 000 FEET

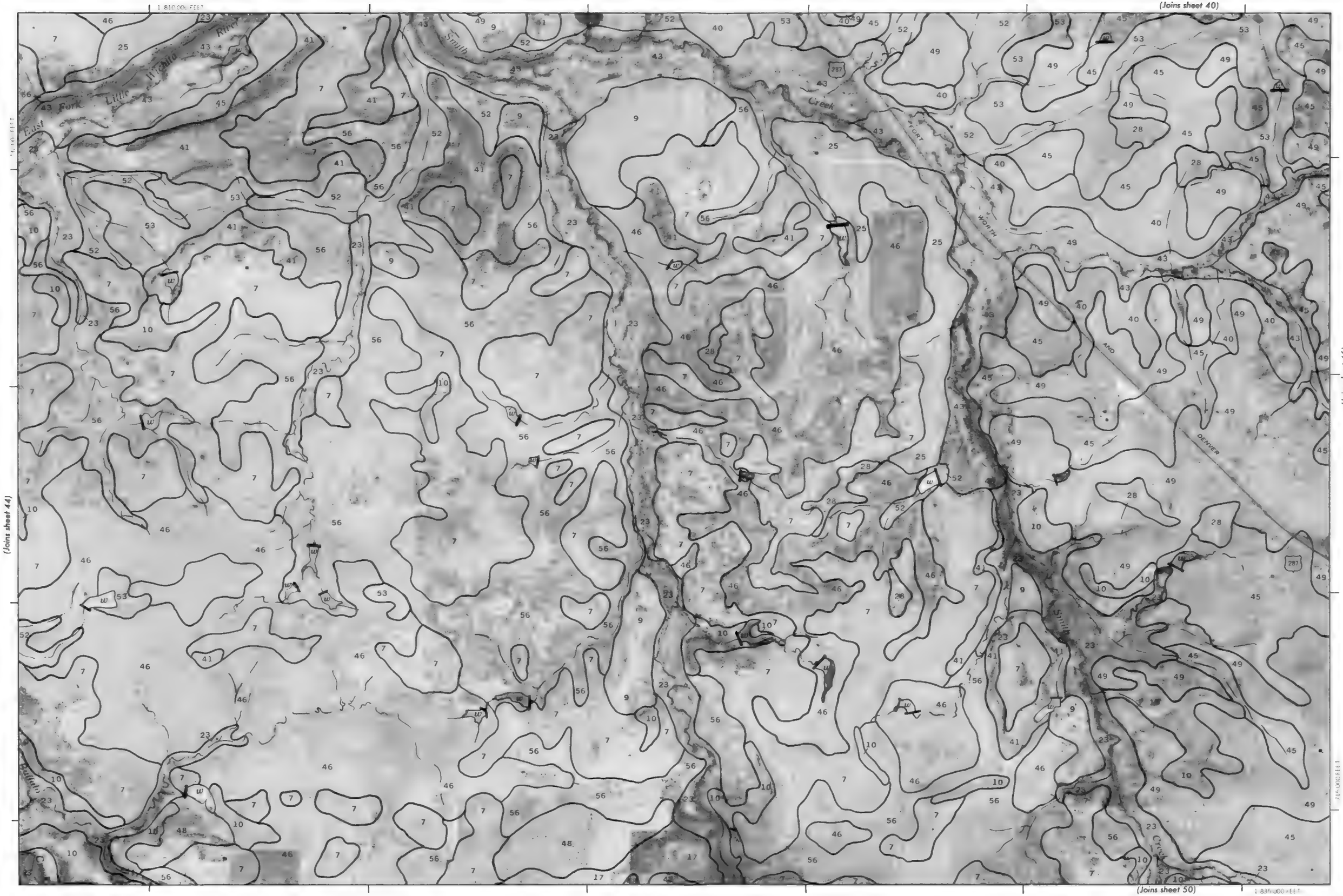
Little Creek

Buffalo Creek

Russell Creek

Russell Creek

CLAY COUNTY, TEXAS — SHEET NUMBER 45



45

N

2 Miles

10000 Feet

5000

Scale 1:24000

0 1000 2000 3000 4000 5000

(46)

N

2 Miles 10000 Feet

1 5000 0 1 2 3 4 5000 FEET

Scale 1:24000

(Joins sheet 41)

(Joins sheet 45)

(Joins sheet 51)

COUNTY

MONTAGUE

FORT WORTH AND DENVER

Bellevue

1288 1286 287

CLAY COUNTY, TEXAS — SHEET NUMBER 47

(Joins sheet 42)

47

N

2 Miles

10000 Feet

(Joins sheet 48)

Scale 1:24000

5000

0

5000

4000

3000

2000

1000

0

COUNTY

ARCHER

East

Little

Oak

water

(Joins sheet 52)

CLAY COUNTY, TEXAS — SHEET NUMBER 48

(48)

N

(Joins sheet 43)

(Joins sheet 47)

(Joins sheet 53)

(Joins sheet 49)

Scale 1:24000

2 Miles 1 0 1

10000 Feet 5000 0 5000

1" = 2000 FEET

Deer Creek

Russell Creek

water

OIL WASTE LAND

CLAY COUNTY, TEXAS — SHEET NUMBER 49

1 780 000 FEET

(Joins sheet 44)

49

N

2 Miles

10000 Feet

(Joins sheet 50)

5000

Scale 1:24000

0 1000 2000 3000 4000 5000

1 805 000 FEET

(Joins sheet 48)

(Joins sheet 54)

1 805 000 FEET

CLAY COUNTY, TEXAS — SHEET NUMBER 50

(50)

N

(Joins sheet 45)

(Joins sheet 49)

(Joins sheet 55)

(Joins sheet 51)

Buffalo Creek

Smith Creek

water

2321

2 Miles 10000 Feet

1 5000

Scale 1:24000

0 0

¼ 1000

½ 2000

¾ 3000

1 4000

1¼ 5000

CLAY COUNTY, TEXAS — SHEET NUMBER 51

(51)

1 840 000 FEET

(Joins sheet 46)

FORT WORTH & DENVER

COUNTY

MONTAGUE

(Joins sheet 50)

(Joins sheet 56)

1 860 000 FEET

N

2 Miles

10000 Feet

Scale 1:24000

CLAY COUNTY, TEXAS — SHEET NUMBER 52

52

N

(Joins sheet 47)

1 745 000 FEET

COUNTY

ARCHER

Creek

Post

water

Little

Scale 1:24000

2 Miles 10000 Feet

1 5000

(Joins sheet 57)

(Joins sheet 53)

CLAY COUNTY, TEXAS — SHEET NUMBER 53

1 750 000 FEET

(Joins sheet 48)

(Joins sheet 52)

(Joins sheet 54)

(Joins sheet 58)

1 775 000 FEET

Deer Creek

Lodge Creek

water

53

N

2 Miles

10000 Feet

5000

Scale 1:24000

CLAY COUNTY, TEXAS — SHEET NUMBER 54

54

N

(Joins sheet 49)

(Joins sheet 53)

(Joins sheet 59)

(Joins sheet 55)

1,805,000 FEET

1,780,000 FEET

Scale 1:24000

2 Miles 10000 Feet

1 5000 0 0 1000 2000 3000 4000 5000

Wichita River

Buffalo Springs

Little Wichita River

Clear Fork

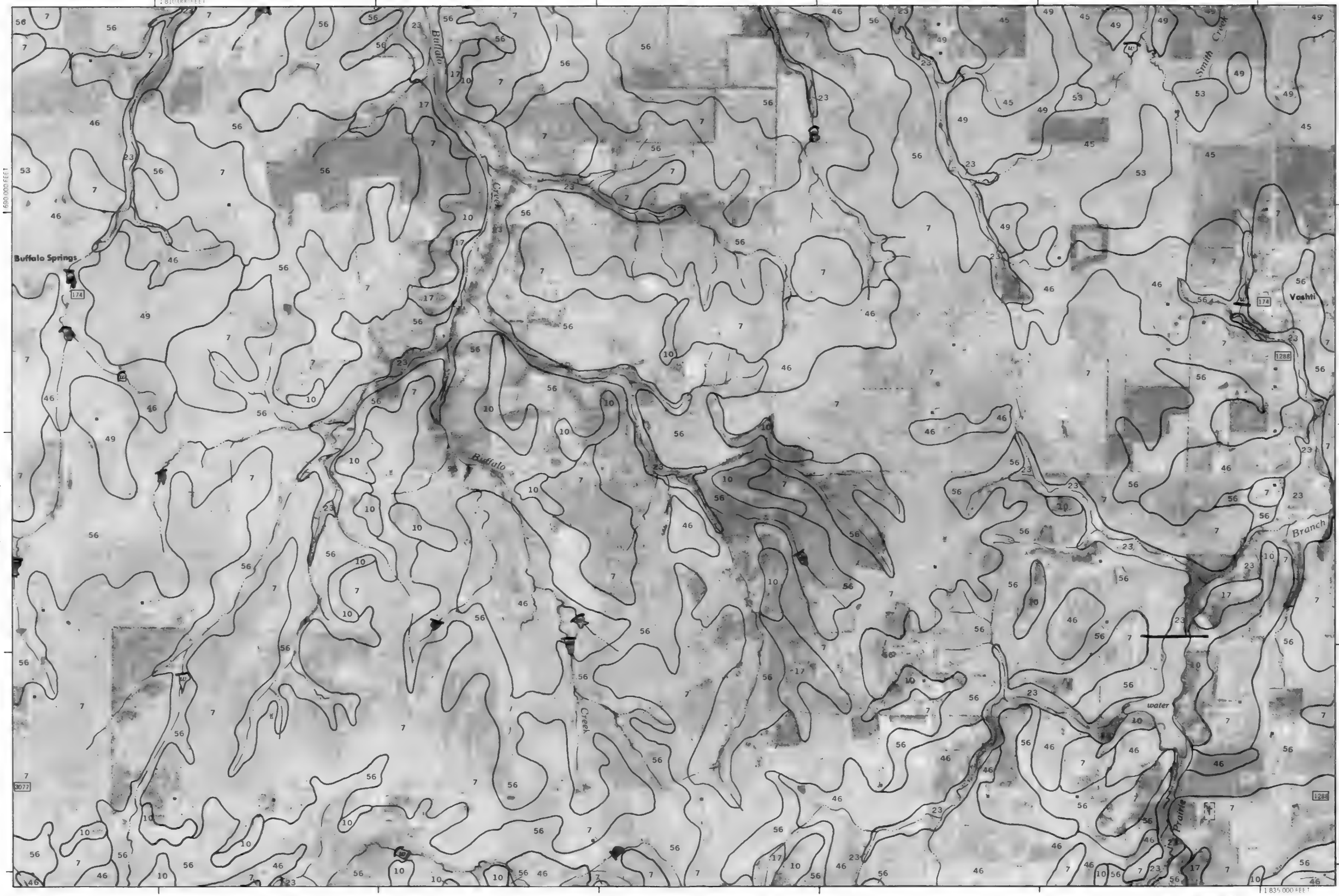
174

148

3077

CLAY COUNTY, TEXAS — SHEET NUMBER 55

55



CLAY COUNTY, TEXAS — SHEET NUMBER 56

(56)

N

(Joins sheet 51)

1 865 000 FEET

COUNTY

MONTAGUE

Vashti

Prairie Branch

Prairie

water

water

(Joins sheet 55)

675 000 FEET

1 840 000 FEET

(Joins sheet 61)

2 Miles 10000 Feet

1 5000 0 1000 2000 3000 4000 5000

Scale 1:24000

CLAY COUNTY, TEXAS — SHEET NUMBER 57

(Joins sheet 52)

1 720 000 FEET

6 710 000 FEET

COUNTY

Post Oak Creek

Little

East

Flat

Creek

Willow

Creek

ARCHER

JACK

COUNTY

1 745 000 FEET

(Joins sheet 58)

57

N

2 Miles

10000 Feet

Scale 1:24000

(Joins sheet 53)

1 775 000 FEET

675 000 FEET

N

2 Miles

10000 Feet

1

5000

(Joins sheet 57)

Scale 1:24000

0 0 1000 2000 3000 4000 5000

660 000 FEET

Willow Creek

Lodge Creek

Willow Creek

Creek

Creek

Lodge

Shannon

175

JACK COUNTY

1 750 000 FEET

(Joins sheet 59)

CLAY COUNTY, TEXAS — SHEET NUMBER 59

1 780 000 FEET

675 000 FEET

(Joins sheet 54)

59

N

2 Miles

10000 Feet

(Joins sheet 60)

5000

Scale 1:24000

660 000 FEET

(Joins sheet 58)

Little Wichita River

East Fork

Prospect

Community

Jones

water

JACK COUNTY

1 805 000 FEET

CLAY COUNTY, TEXAS — SHEET NUMBER 60

(60)

N

(Joins sheet 55)

1 835 000 FEET

(Joins sheet 59)

660 000 FEET

(Joins sheet 61)

1 810 000 FEET

JACK COUNTY

Scale 1:24000

2 Miles 10000 Feet

1 5000 0 0 1000 2000 3000 4000 5000

Jones Creek

Prairie Branch

Big Sandy Creek

CLAY COUNTY, TEXAS — SHEET NUMBER 61

61

1 840 000 FEET

(Joins sheet 56)

670 000 FEET

(Joins sheet 60)

COUNTY

MONTAGUE

Creek

Sandy

Newport

JACK COUNTY

1 865 000 FEET

655 000 FEET

N

2 Miles

10000 Feet

Scale 1:24000